HDI 4000 Field Service Manual

4730-0037-02 B

February 2003

PHILIPS

About This Manual

Audience

This manual supports the field service maintenance and repair of the HDI® 4000 Ultrasound System. The user of this document is a qualified ultrasound electronics technician who has completed training classes on the system and its peripherals.

Manual Format

This manual is in Portable Document Format (PDF), for viewing on a laptop computer with Acrobat Reader. A list of bookmarks functions as an additional table of contents. Those bookmarks, the table of contents, and cross-references use hypertext links to provide access to the referenced information.

Conventions in This Manual

The following conventions are used in this manual:

- Hypertext links are blue.
- All procedures are numbered. You must complete steps in the sequence they are presented to ensure reliable results.
- Bulleted lists indicate general information about a function or procedure. They do not imply a sequential procedure.
- Control names and menu items or titles are spelled as they are on the system, and they appear in bold text.
- Symbols appear as they appear on the system.
- Scanheads and pencil probes both are referred to as scanheads, unless the distinction is important.
- An English system is assumed.

Service Manual Questions or Comments

If you have questions about the service manual, or you discover an error in the manual, contact Philips Ultrasound Technical Publications:

- atl-bothell.techpubs@philips.com
- Technical Publications, MS 964, at the address below

Customer Assistance

Various support locations around the world can provide customers with technical assistance regarding the ultrasound system. Customers should contact the sales office where they purchased the system or the nearest Philips Ultrasound office. Office addresses and telephone numbers are in the system user documentation.

Philips Ultrasound
P.O. Box 3003
Bothell, WA 98041-3003
USA
(425) 487-7000 or (800) 426-2670
www.ultrasound.philips.com

Contents

1 General Information

Introduction

This section contains a general overview and physical description of the HDI® 4000 Ultrasound System. System application, feature, and regulatory information are summarized.

System Overview

The HDI 4000 system (Figure 1-1 through Figure 1-4) is a general-purpose, mobile, software-controlled, diagnostic ultrasound system.

The HDI 4000 system uses a personal computer (PC) platform with a Windows 2000 Professional operating system and digital broadband beamforming to provide high-resolution, high-penetration ultrasound imaging.

The HDI 4000 system uses linear array, convex array, phased array, static and, volume scanheads to perform all major clinical applications. The standard operating modes are 2D/gray scale, M-mode, color M-mode, color Doppler, Color Power Angio® (CPA) imaging, pulsed-wave (PW) Doppler, steered continuous-wave (CW) Doppler, static CW Doppler, Tissue Harmonic Imaging, Pulse Inversion Harmonic Imaging and tri-plex mode simultaneous. Volume 3D imaging mode is optional.

The system can store up to 40,000 images (depending on hard disk drive installed and image file size) and recall them. Data can be exported to a removable disk and transferred to the PC environment in either JPEG or BMP formats. High-density removable media capability is standard, and the system supports compatible ink-jet printers.

The HDI 4000 system has an online Help feature. Help displays instructions for use of the HDI 4000 system on-screen, by pressing the **?** button on the control panel.

Figure 1-1 **HDI 4000 Ultrasound System**

Pull-out keyboard
See Figure 1-3

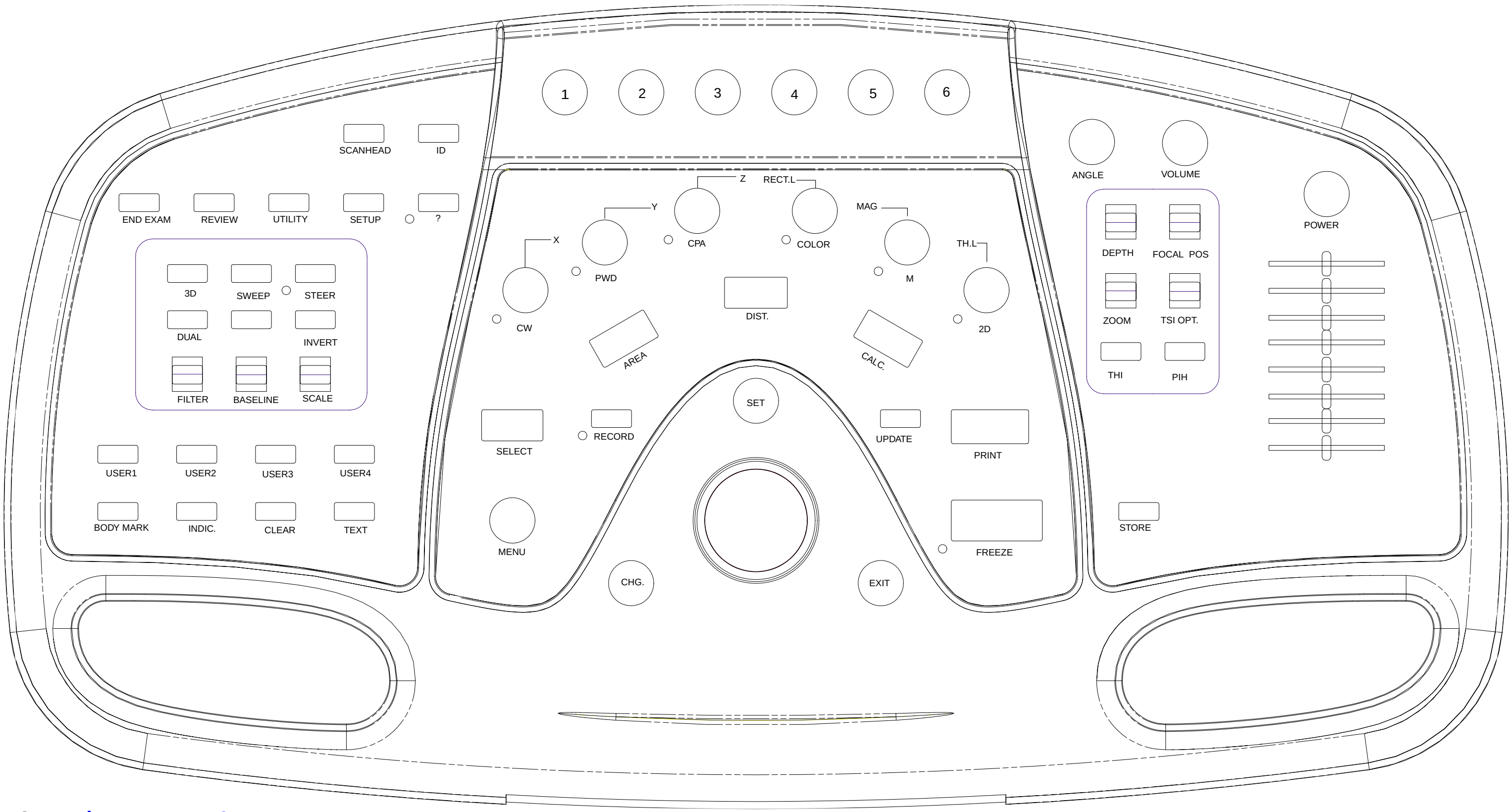
Figure 1-2 **HDI 4000 Ultrasound System (Philips Colors)**

Figure 1-3 **Control Panel and Pull-out Keyboard**

Overlay
See Figure 1-5

Figure 1-4 Control Panel (Philips Colors)

Figure 1-5 Control Panel Labeling (English)



See Figure 14-10

Applications

- Abdominal
- Breast
- Cardiac
- Cardiac TEE
- Carotid
- Fetal Echo
- General
- GYN
- Intra-Operative
- Musculoskeletal
- Neo-natal Head
- OB
- Pediatric
- Pediatric Abdomen
- Pediatric Cardiology
- Prostate
- Renal
- Small Parts
- Trans-Cranial Doppler (TCD)
- Vascular
- Venous

Features

Electrical Standard

- 120 Vac, 60 Hz
- 240 Vac, 50 and 60 Hz

Languages

- English
- French
- German
- Italian
- Spanish

Scanhead Selection

- Four scanhead receptacles
- Electronic switching between scanheads

Imaging Modes

- Real-time 2D gray-scale imaging
- Motion mode (M-mode)
- Color Doppler Imaging
- Color Power Angio Imaging
- Pulsed-wave (PW) Doppler
- Continuous-wave (CW) Doppler (steered and static)

- Tissue Harmonic Imaging (Cardiac and General applications only for P4-2, P5-3, and MPT7-4 prior to v1.01.00.063 software and L7-4, C5-2, C7-4, 3D5-3, 3D7-4, CL15-7, P4-2, P5-3, P7-4, and MPT7-4 for v1.01.00.063 and higher software)
- Pulse Inversion Harmonic Imaging 2D real-time and 3D (P7-4 Pediatrics and General; P5-3 Cardiac and General; P4-2 Cardiac, General, and Contrast (Contrast is v1.01.00.063 and higher software); MPTEE all applications; and for v1.01.00.063 and higher software, C5-2 General, Abdominal, Renal, Abdomen, and Contrast; 3D5-3 all applications; and 3D7-4 all applications)
- 1.01.00.063 and higher software, Contrast Specific Imaging (CSI) application is available for the C5-2 and P4-2

Image Presentation

- Top/Bottom
- Left/Right
- Dual side-by-side

Image Processing

- Depth control
- View Area control
- Direction (Left & Right) control
- Apex (Up & Down) control
- Zoom control
- Focus (position & number) control
- Reject Level selection

- Gain control
- Dynamic Range control
- TGC Value adjustment
- Power control
- Persistence control
- Capture control
- Tag control
- Histogram utility
- 3D controls

Image Storage and Retrieval

- 256-frame Cine review memory
- Save images to and retrieve and view images from the system hard disk (in proprietary format)
- Copy images to the MO disk (in BMP or JPEG format) or to the CD-R/W disk (in BMP or DICOM format, depending on the operation). Images can be backed up in a DICOM or 3D format or exported in JPEG, TIF, or BMP format).

Backup and Export to CD-RW and CD-R

With v1.01.00.063 and higher software, you can reuse CD-RW (rewritable) and CD-R (recordable) disks for backup and export operations if the disk has sufficient disk space left. This allows you to continue to add images and studies to a CD-RW or CD-R without reformatting and deleting information from the disk.

Measurements

- 2D mode: Distance, Angle, Area, Ellipse, Circumference, Volume.
- Doppler: Velocity, Pressure, Acceleration.
- M-mode: Time, Slope, Distance.
- Pre-measurement calibration of VCR images from HDI 4000 system.
- The images stored to Review can be recalled and measured for both distance and area. These measurements cannot be transferred to any of the analysis packages, but the measurements can be recorded to hard copy.

Calculations

- Automatic measurement of various parameters
- Obstetrical analysis in 2D
- GYN
- Cardiology
- Vascular
- Standard Gestational Age tables
- Standard OB tables
- User-defined OB tables

DICOM

- Modality worklist
- Simultaneous network print and store

Open Line Transfer

Open line serial data transfers of OB patient report to off-line printers, computers, and workstations (the data is sent to and appears on a computer monitor or prints on a serial printer).

On-System User Instructions (Online Help)

An online Help feature provides instructions for use of the HDI 4000 system, on-screen, by pressing the **?** button on the control panel.

Scanheads Supported

- Linear array
  - L7-4
  - L12-5 38 mm/50 mm
  - CL15-7
- Curved array
  - C5-2
  - C7-4
  - C8-4v
  - C9-5
  - C8-5
- Phased array
  - P4-2
  - P7-4
  - P5-3
  - MPT7-4

- Dual Element Pencil Scanhead
  - D2 CW
  - D5 CW
- Volume Scanhead
  - 3D5-3
  - 3D7-4
  - 3D8-5v

Peripherals

- Panasonic AG-MD835 Video Cassette Recorder (purchase option - Figure 1-6)
- Sony UP-895MD Black and White Video Page Printer (purchase option - Figure 1-6)
- Mitsubishi CP800 Color Video Page Printer (purchase option - Figure 1-6)
- Sony UP-21MD Color Video Page Printer (purchase option - Figure 1-6)

CAUTION

To avoid damaging the Sony UP-21 Printer, if the need arises, be sure to secure the thermal printing head before shipping as described in “To secure the Sony UP-21 print head for transport:” on page 182.

Physical Description

System Components

- Primary printed circuit boards (PCBs):
  - Probe Select Assembly (PSA)
  - Beamformer (BF)
  - Continuous Wave Doppler Processor (CW)
  - Digital Scan Converter (DSC)

- Digital Signal Processor (DSP)
- Video Manager (VM)
- Backplane (ultrasound motherboard)
- PC Motherboard
- ECG

• System operating software

• Mobile cart/system housing

- Color VGA monitor with tilt/swivel base
- Main chassis (supports the monitor, control panel, disk drives, scanhead connectors, cable management system, and storage areas)
- Control panel and pull-out keyboard
- I/O connection panel

Safety Requirements

HDI 4000 complies with the requirements for the International Electrotechnical Commission (IEC), Canadian Standard Association (CSA), and Underwriters Laboratories (UL).

• IEC 60601-1

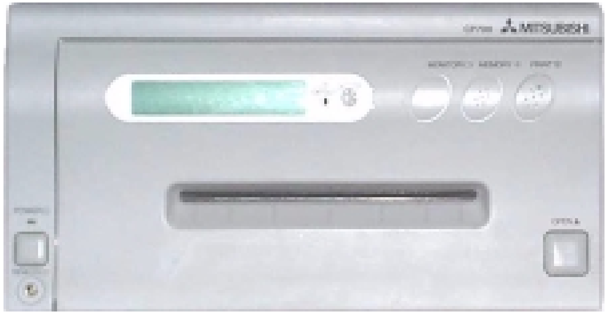
• CSA22.2 No. 601.1

• UL 2601-1

Figure 1-6 HDI 4000 System Peripherals

- UP-21MD Sony Color Video Printer -

- UP-895MD Sony Video Graphic Printer -
(Black and White)



- CP800 Mitsubishi Color Printer -

- AG-MD835 Video Cassette Recorder -

Supplies and Accessories

Philips product-specific and general purpose supplies and accessories, including scanhead biopsy guides, are available from CIVCO Medical Instruments at the addresses and numbers below. Supplies and accessories are no longer available from Philips.

CIVCO Medical Instruments
102 First St. South
Kalona, IA 52247-9589

Phone:	(800) 445-6741, Ex. 1 for Customer Service (USA) (319) 656-4447 (International)
Fax:	(877) 329-2482 (USA) (319) 656-4451 (International)
E-mail:	info@civcomedical.com
Internet:	www.ultrasoundsupplies.com

2 Specifications

Introduction

This section summarizes the system specifications for the HDI 4000 Ultrasound System. Scanhead specifications are provided in Section 15, “Scanheads”.

System Specifications

The configuration of the computer platform is as follows:

- PC with Intel processor
- 512 MB main memory
- 40 GB HDD (may be a 20-GB HDD in earlier systems)
- MO drive
- CD-R/W drive
- Sound/LAN/VGA capabilities
- PC Interface for ultrasound module interface

Table 2-1 HDI 4000 System Physical Specifications and Limits

Parameter	Value
Height	1492 mm (58.7 in)
Width	692 mm (27.2 in)
Depth	1115 mm (43.9 in)
Weight without peripherals	approximately 166 kg (365 lbs)
Ambient Operational Temperature	10°C to 40°C (50°F to 104°F)
Operational Relative Humidity	15% to 95% RH (non-condensing)

Table 2-1 HDI 4000 System Physical Specifications and Limits (Continued)

Parameter	Value
Storage and Shipping Temperature	-25°C to 65°C (-13°F to 149°F)
Storage Relative Humidity	20%-95%

1. Atmospheric pressure (Storage) at 1,060 hPa to 500 hPa (375–795 mmHg).
2. Atmospheric pressure (Operating) at 1,060 hPa to 700 hPa (525–795 mmHg).

Table 2-2 HDI 4000 System Electrical Power Specifications

Parameter	Value
Hot/Neutral	90-132 Vac (RMS) at 50 or 60 Hz + 3 Hz 180-264 Vac (RMS) at 50 or 60 Hz + 3 Hz
Current Draw (rated)[1]	10 A (at 100–120 Vac) 5 A (at 200–240 Vac)
Current Draw (measured)	6.79 A (at 120 Vac) 3.50 A (at 240 Vac)
Power Draw (measured)	811 VA (at 120 Vac) 840 VA (at 240 Vac)
Source	< 48 A
Thermal Load[1]	Approximately 2,550 BTU
Power Dissipation1, maximum	763 W (at 120 Vac) 775 W (at 240 Vac)
Chassis leakage current 100-240V systems	500µA max

Table 2-2 HDI 4000 System Electrical Power Specifications (Continued)

Parameter	Value
Dielectric withstand voltage (DWV) between isolation transformer primary and secondary	4000V
DWV between AC mains and exposed conductive parts (chassis)	1500V
DWV between patient applied parts and AC mains	4000V

1. Includes the effect of peripherals operating at their maximum normal condition (for example, recording or printing).

Table 2-3 Temperature/Humidity limit

	Storage/Shipping	Operating Environment
High Temperature	65°C	40°C
Low Temperature	-25°C	10°C
Non-condensing relative humidity	20%–95%	15%–95%

Wiring Specification

The electrical feed to the system shall be a dedicated line (no other equipment on the same line) with a third-wire ground. The ground wire shall be an insulated solid copper conductor bonded to the ground bus of the service panel. The outlet shall be a Hospital Grade Receptacle or an Isolated Ground Receptacle. Proper installation shall reflect compliance with the national electrical code or the appropriate governing body.

3 Safety

Introduction

This section summarizes the safety information for the HDI 4000 Ultrasound System.

Safety Information

Please read this information before using or servicing a Philips ultrasound system. It applies to the ultrasound system, scanheads, recording devices, and any optional equipment.

This device is intended for use by, or by the order of, and under the supervision of a licensed physician qualified to direct the use of the device.

In this manual, **WARNING** is used to indicate the presence of a hazard that can cause personal injury, death, or substantial property damage if the warning is ignored.

In this manual, **CAUTION** is used to indicate the presence of a hazard that can cause equipment damage if the caution is ignored.

In this manual, **NOTE** is used when additional comment or explanation is required about installation, operation, or maintenance information that is important but not hazard-related.

Mechanical Safety

WARNINGS

- The system is heavy, be careful when moving it, especially going up and down stairs. Normally, as many as four adults are required to move the system manually on stairs.
- Philips recommends pushing the system, instead of pulling it, and exercising special caution when going up or down ramps.
- Unlock the front wheel brake before attempting to move the system.

Electrical Safety

This equipment has been certified by a recognized third-party testing agency as a Class I device with Type BF isolated patient-applied parts. For maximum safety observe these warnings:

WARNINGS

- Before connecting and applying power, any mounting screws that complete the system ground path must be in place and properly secured.
- Shock hazards may exist if this system is not properly grounded. Protection against electrical shock is provided by grounding the chassis with a 3-wire cable and plug. The system must be plugged into a hospital-grade three-prong outlet. The grounding wire must not be removed or defeated.
- Hazardous voltages are present inside the system. Cabinet panels must be in place while the system is in use. All internal adjustments and replacements must be made by a qualified Philips field service engineer

WARNINGS

- Do not operate this system in the presence of flammable gases or anesthetics. Explosion can result.
- Always inspect the scanhead face, housing, and cable before use. Do not use the scanhead if the face is cracked, chipped, or torn, if the housing is damaged, or if the cable is abraded.
- Always turn the system power off and disconnect it from the wall outlet prior to cleaning the system.
- Connection of optional devices not supplied by Philips could result in electrical shock. When such optional devices are connected to your ultrasound system, ensure that the total system chassis risk current does not exceed 100 µA for 120 Vac systems and 500 µA for 230 Vac systems.
- In general, only the area of the scanhead acoustic window is watertight. Except where specified in specific scanhead cleaning instructions, do not immerse the remainder of a scanhead in any liquid.

CAUTIONS

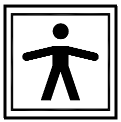
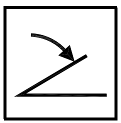
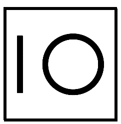
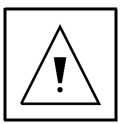
- This equipment contains components that are electrostatic sensitive. Proper anti-static procedures, protection, and equipment must be used prior to opening and during handling of this equipment. Failure to use ESD procedures will damage the components. Such damage to components is not covered by Philips warranties.
- Do not connect or disconnect scanheads without first placing system in FREEZE mode.
- Damage to the system may occur if the system power is incorrectly configured and the system is connected to an improper power source.

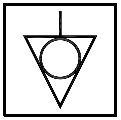
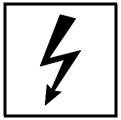
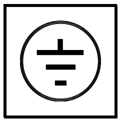
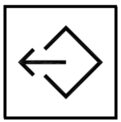
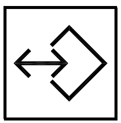
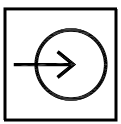
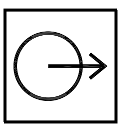
CAUTIONS

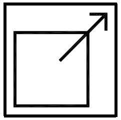
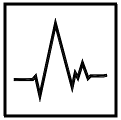
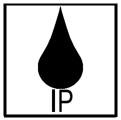
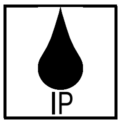
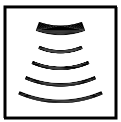
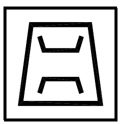
- Damage to a peripheral may occur if the OEM power is incorrectly configured and the OEM is connected to an improper power source.
- Always turn the power off and wait at least 30 seconds before removing or installing any PCB, module, or component.

Safety Symbols

The International Electrotechnical Commission (IEC) has established a set of symbols for medical electronic equipment, which classify connections or warn of any potential hazards. The classifications and symbols are shown below.

	Isolated patient connection (IEC 601-1-Type BF)
	Footswitch
	I and O on power switch represent ON and OFF, respectively.
	This symbol identifies a safety note. Ensure you understand the function of this control before using it. Control function is described in the unit's operation manual.

	Identifies equipotent ground (located next to ground stud on the rear panel) (IEC 417-5021).
	Identifies high voltage components operating above 1000 Vac or 1500 Vdc.
	Identifies the point where the system safety ground is fastened to the chassis.
	VGA or PARALLEL Output port
	RS232C or LINE/USB/DICOM Input/Output port
	AUDIO Left/Right, VHS/S-VHS, MIC, or DVD Input port
	AUDIO Left/Right, VHS/S-VHS, Output port VIDEO PATIENT MONITOR, B/W PRINTER or INTERLACE RGB Output port

	PRINT REMOTE Output
	ECG Connection
	Watertight equipment
	Drip-proof equipment
	Scanhead Connection
	Pencil Probe Connection

4 Theory of Operation

Introduction

This section provides a functional description of the HDI 4000 Ultrasound System.

System Architecture

The HDI 4000 system architecture is made up of six fundamental functional elements:

- Physical assemblies comprising the mobile cart and system components
- Power functions
- Control functions
- Ultrasound signal generation and echo acquisition functions
- Signal and image data processing and analysis functions
- Visual and audio presentation functions

The location and identification of the physical parts of the system are described in the General Information, Cabling, Configuration, and Parts sections of this document. The functional nature of each is described in the following paragraphs.

System power development and distribution is provided by the installation site source voltage, the system power supply, the backplane power bus, and power interconnect cables (see “Operating Power” on page 50).

The control, acquisition, processing, and presentation elements of the system architecture are supported by a Pentium processor computer platform that provides a real-time operating system with hardware and software interfaces to the disk drives, control panel, and peripherals. This platform is combined with ultrasound electronics which include a digital beamformer and ultrasound software.

The HDI 4000 system ultrasound engine is physically and functionally made up of the Industrial PC Motherboard (Motherboard), four digital Beamformer (BF0-BF3) PCBs, Continuous Wave

Doppler Processor (CW) PCB, Digital Signal Processors (DSP) PCB, Digital Scan Converter (DSC) PCB, and Video Manager (VM) PCB. Most of the ultrasound signal processing, image processing, analysis, and display functions are performed by software using the native processing power of the computer (Industrial PC Motherboard).

Operating System

The full-service, real-time Windows 2000 operating system provides an integrated range of resources: drivers and handlers for storage, video, serial and parallel ports, and support of file system services and graphical user interfaces. The operating system, based on a Pentium processor, is resident on the hard drive. The system software performs these tasks:

- Processes requests from the control panel
- Sets up beamforming parameters
- Processes acquired ultrasound echoes into digital visual representations for conversion into analog signals
- Performs measurements and calculations on acquired data
- Stores acquired data (such as images and user-entered data) for subsequent retrieval
- Performs all necessary functions to coordinate software tasks

Functional Description

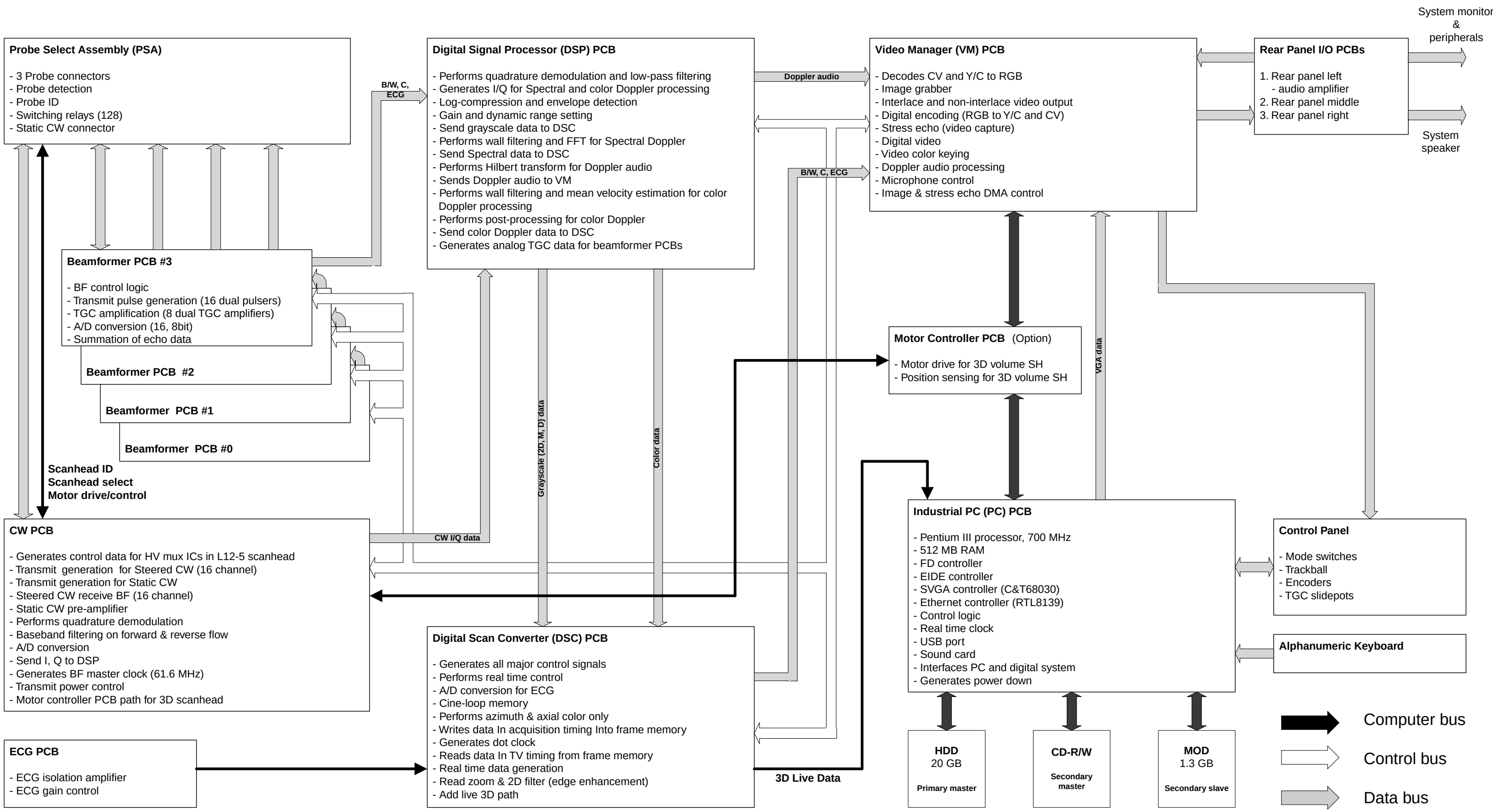
The HDI 4000 system produces 2D, M-mode, color Doppler, color power angio, Doppler, and 3D ultrasound images using transducers (scanheads), digital beamforming, and Doppler processing. The central processing unit of the system is the Industrial PC Motherboard. The ultrasound components comprise digital beamformer technology that combines with the operating system to support the system functions.

The HDI 4000 system stores the ultrasound images and patient data on the hard drive and can copy that data to the removable media, such as magneto-optical (MO) disks and CD-R/W disks for off-line review. The system can send the images to a black-and-white printer, color printer, or to a VCR. It also generates reports that can be printed.

After operating power is applied, the major functional elements combine to produce ultrasound images. The user interface allows system control and viewing of the results. Figure 4-1 is a simplified block diagram of the HDI 4000 system, showing the relationship among those major functional elements and indicating the primary functional tasks performed by each. The diagram organizes the functional elements as they exist on the system hardware.

The overall system functional flow is power development and distribution, analog signal processing, beamforming, continuous-wave and color Doppler processing, scan conversion, digital signal processing, and video and audio presentation. Figure 4-13 is a diagram of the system 2D, M-mode, Doppler, and color data paths.

Figure 4-1 HDI 4000 System Functional Block Diagram



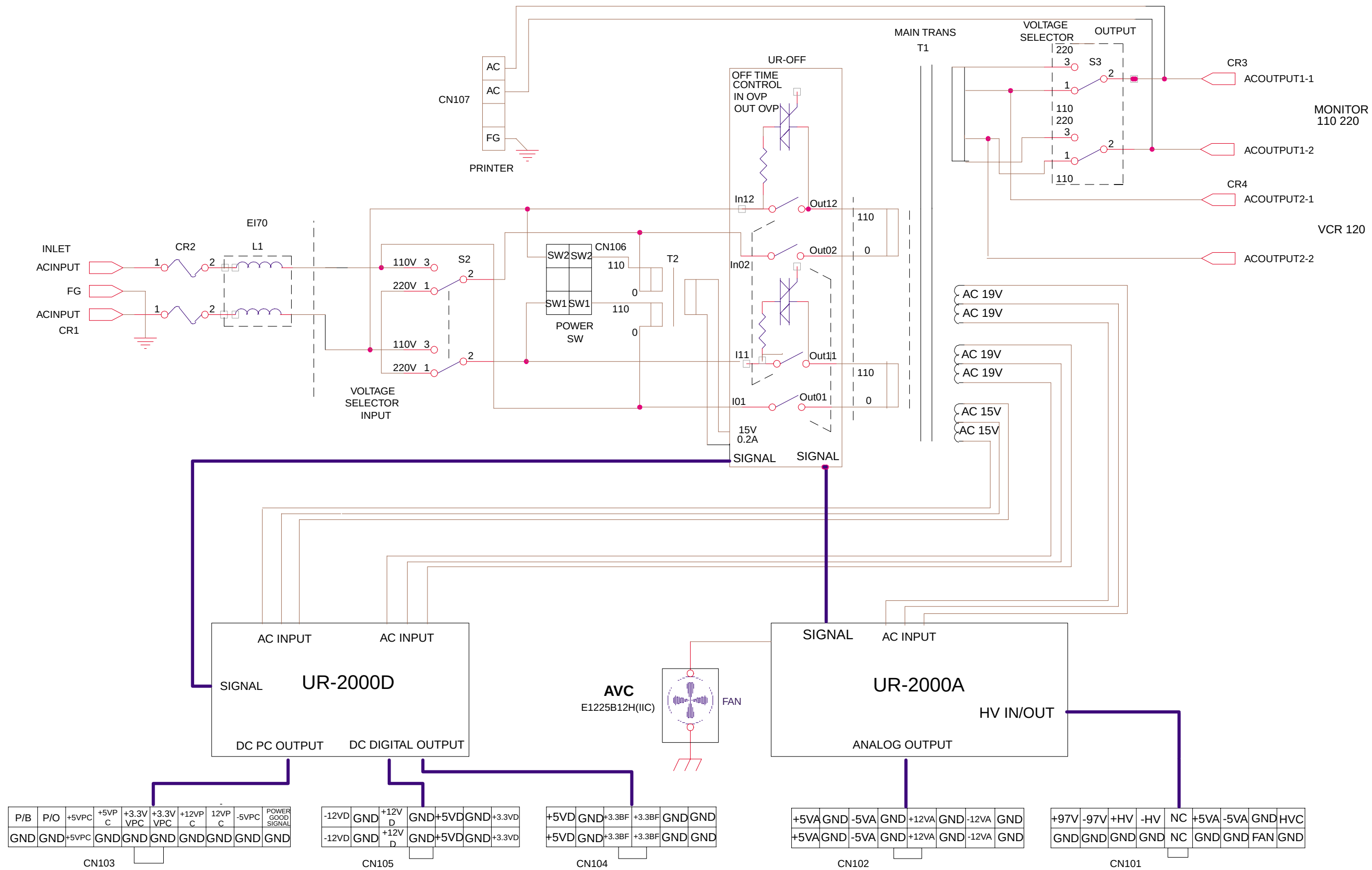
Operating Power

The AC power source voltage connects directly to the system power supply, which also comprises the rear panel. The power supply is configured for 115 or 230 Vac operation. (see "Setting Up the System" on page 96). A system power distribution diagram is shown in Figure 11-2. The power supply output voltages are listed in Table 4-1. Figure 4-2 is a simple schematic diagram of the power supply.

Table 4-1 Power Supply Output Voltages

Voltage	Use
+3.3 Vdc	Computer, Digital Logic, Beamformer
+5 Vdc	Computer, Hard Drive, MO Drive, CDR Drive, Digital Logic, Beamformer, Keyboard
-5 Vdc	Computer, Beamformer
+12.2 Vdc	Computer, Hard Drive, MO Drive, CDR Drive, Digital Logic, Beamformer, Rear Panel, Fan
-12.2 Vdc	Computer, Digital Logic, Rear Panel, PSA
+10 to 80 Vdc (+HV)	Beamformer
-10 to 80 Vdc (+HV)	Beamformer
0~5 Vdc	Acoustic power control

Figure 4-2 Power Supply Schematic Diagram



Probe Select Assembly (PSA)

Figure 4-3 is a simple block diagram of the Probe Select Assembly, which provides the function of a scanhead select module. The PSA is the system interface for three scanheads and the CW pencil probe (“General Information” on page 21 and “Scanheads” on page 303). It contains circuits for scanhead detection and identification, engaging the appropriate number of relays to accommodate transmitting and receiving pulses and echoes. The PSA has three 260-pin Cannon connectors and one coax-pin Lemo connector. Figure 4-4 shows the pin grid for the Cannon connector and Figure 4-5 the pin layout for the Lemo connector.

The PSA receives high-voltage pulse signals from the Beamformer PCBs [Beamformer (BF0-BF3)] and switches them through analog relays as inputs to the active scanhead to generate the ultrasound signal. The returning echoes are passed through these relays and back to the Beamformer PCBs for processing. Scanhead ID, scanhead select, and motor drive/control data is exchanged with the Continuous Wave Doppler Processor (CW) PCB.

Figure 4-3 Probe Select Assembly Block Diagram

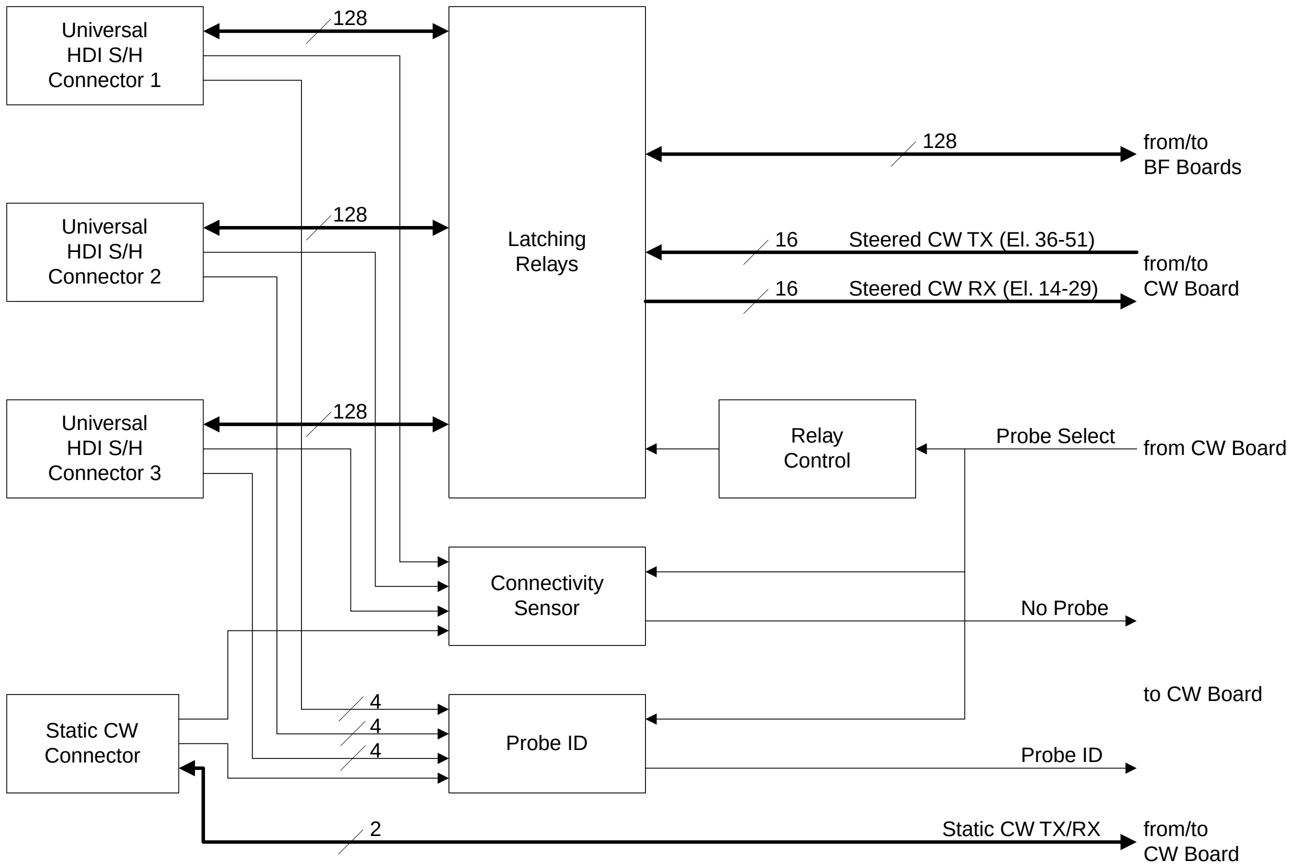
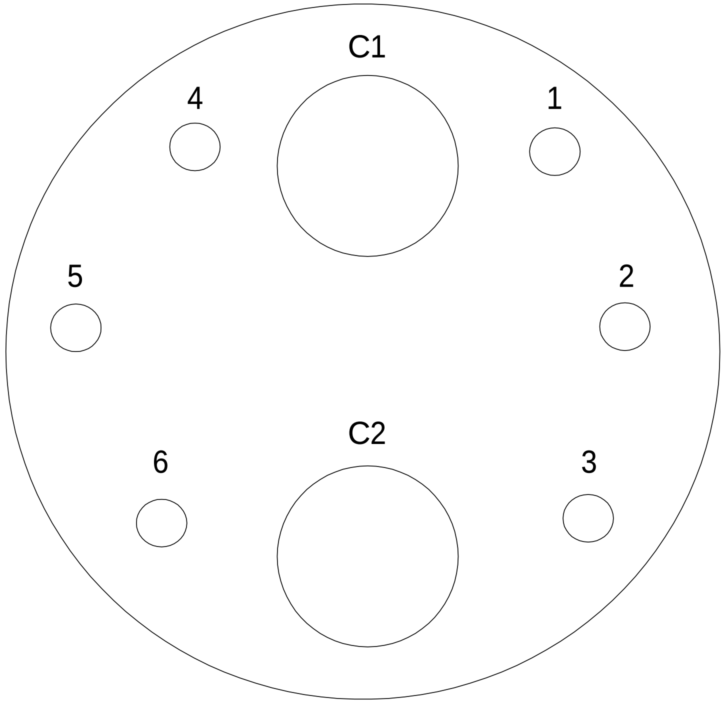


Figure 4-4 Cannon Scanhead Connector Pin Grid

	1	2	3	4	5	6	7	8	9	10
A	SHG	SHG	PDAT	PCLK	FSEL	PWEN	PPWF	GND	SHG	SHG
B	GND	MOTA	MOTB	MOTC	MOTD	PINT*	ENCXA	ENCXB	ENCXZ	GND
C	GND	MOTA	MOTB	MOTC	MOTD	-5VUS	ENCYA	SGNYB	SGNYZ	GND
D	GND	XD0	XD1	XD2	XD3	XD4	XD5	XD6	XD7	GND
E	GND	HV+	HV-	X+12	X-12	XLD	XCLK	X+5	XGND	GND
F	GND	TST1	TST2	S0	S1	S2	S3/ TDO	S4/ TDI	S5/ TCK	TMS
G	ELG	ELG	ELG	ELG	ELG	ELG	ELG	ELG	ELG	ELG
H	ELG	XD8	XD9	XD10	XD11	XD12	XD13	XD14	XD15	ELG
J	ELG	ELG	ELG	ELG	ELG	ELG	ELG	ELG	ELG	ELG
K	FLG	FL93	FL94	FL95	FL96	FL97	FL98	FL99	FL100	FLG
L	ELG	EL92	EL91	EL90	EL89	EL104	EL103	EL102	EL101	ELG
M	ELG	EL85	EL86	EL87	EL88	EL105	EL106	EL107	EL108	ELG
N	CLG	CL84	CL83	CL82	CL81	CL112	CL111	CL110	CL109	CLG
P	ELG	EL77	EL78	EL79	EL80	EL113	EL114	EL115	EL116	ELG
R	ELG	EL76	EL75	EL74	EL73	EL120	EL119	EL118	EL117	ELG
S	FLG	FL69	FL70	FL71	FL72	FL121	FL122	FL123	FL124	FLG
T	ELG	EL68	EL67	EL66	EL65	EL128	EL127	EL126	EL125	ELG
U	ELG	EL4	EL3	EL2	EL1	EL64	EL63	EL62	EL61	ELG
V	CLG	CL5	CL6	CL7	CL8	CL57	CL58	CL59	CL60	CLG
W	CLG	CL12	CL11	CL10	CL9	CL56	CL55	CL54	CL53	CLG
X	ELG	EL13	EL14	EL15	EL16	EL49	EL50	EL51	EL52	ELG
Y	CLG	CL20	CL19	CL18	CL17	CL48	CL47	CL46	CL45	CLG
Z	ELG	EL21	EL22	EL23	EL24	EL41	EL42	EL43	EL44	ELG
a	FLG	FL28	FL27	FL26	FL25	FL40	FL39	FL38	FL37	FLG
b	FLG	FL29	FL30	FL31	FL32	FL33	FL34	FL35	FL36	FLG
c	SHG	SHG	REF+	SNS1	SNS2	SNS3	SNS4	GND	SHG	SHG

Figure 4-5 **Lemo Connector Pin Layout**

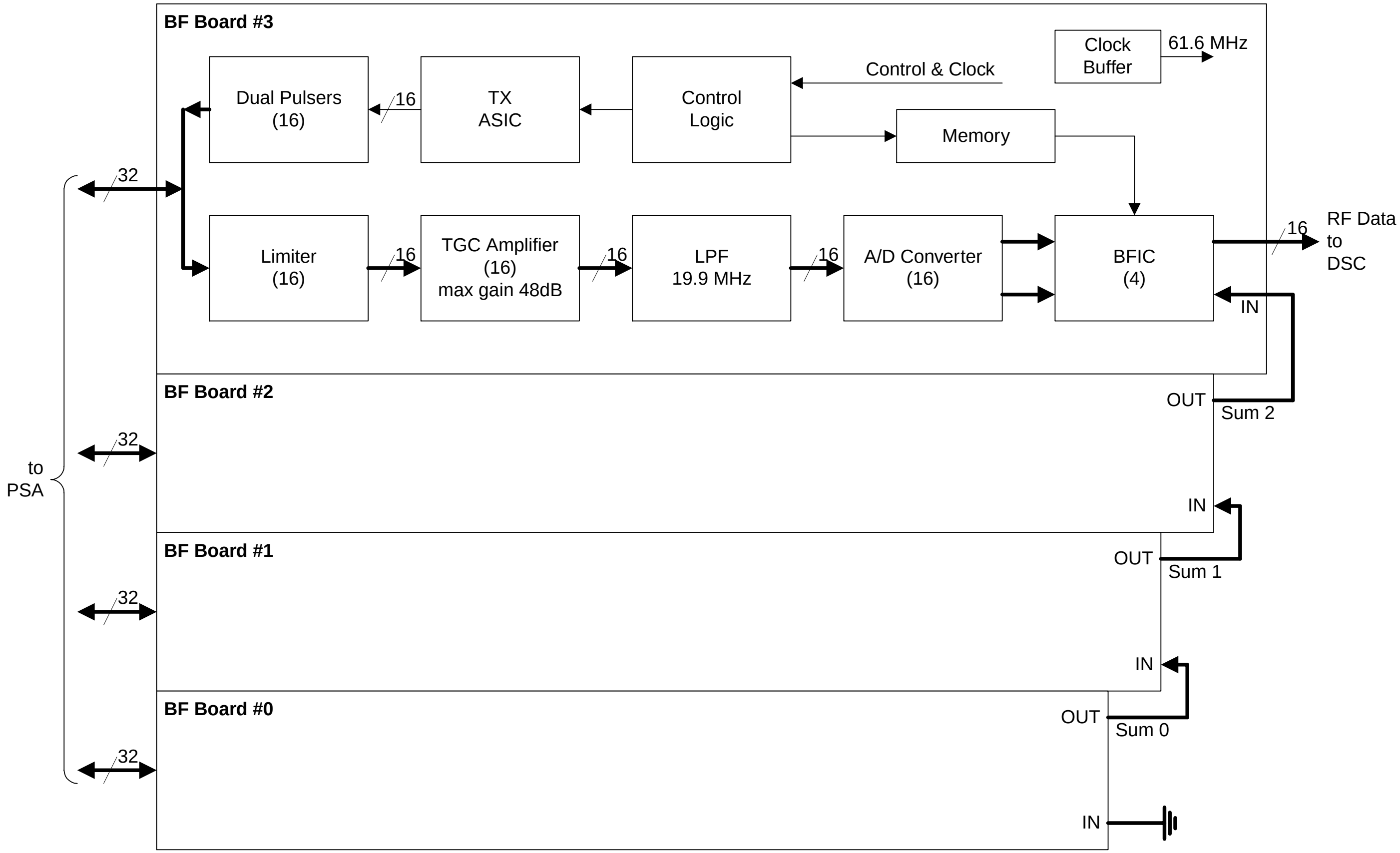


Beamformer (BF0-BF3)

Figure 4-6 is a functional diagram of the Beamformer module, which is made up of four identical Beamformer PCBs. The Beamformer PCBs are responsible for generating and transmitting pulses to the scanhead elements. When the returning echoes come back into the system, they are sent in analog form to the Beamformer PCBs for processing, where the returning echoes are amplified using time gain compensation (TGC), and are filtered prior to being converted into digital data. Once the data is digitized, it is sent to specialized circuits that perform the beamforming.

The signal processing functions of digital beamforming that determine the real image quality of the system include dynamic apodization, multiplication, coefficient loading, variable sample clock generation, summation of the channels within each board, and dynamic gain control.

Figure 4-6 **Beamformer Block Diagram**



Continuous Wave Doppler Processor (CW)

Figure 4-7 is a functional diagram of the CW PCB.The CW PCB functions that support static CW and steered CW are:

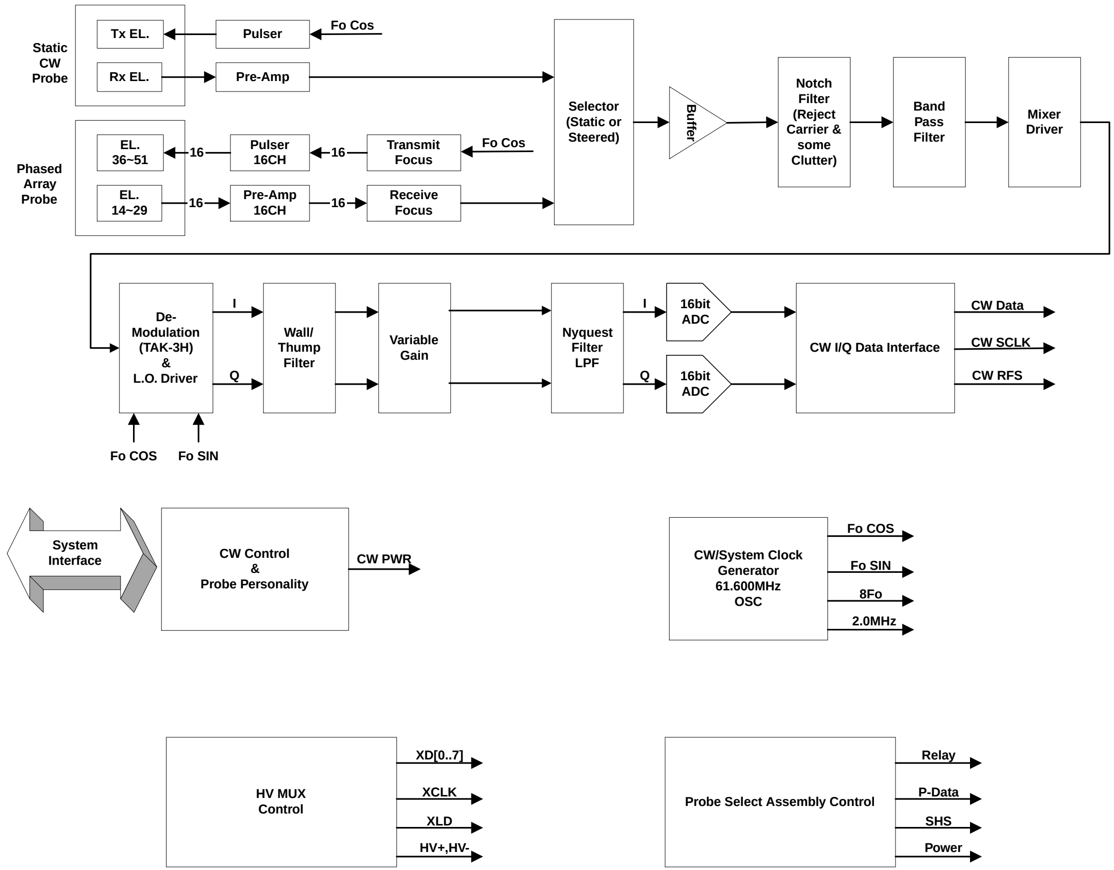
Static CW

- CW pulser to drive scanhead transducer
- RF pre-amplifier to receive signal
- Mixer to change from RX signal to baseband signal with 50 kHz range of right-angle phase (0 and 90 degrees)
- Thump filter (200/2 kHz)
- Variable Wall filter (Min. 200 Hz)
- Variable gain
- Variable lowpass filter with 1 kHz resolution for noise bandwidth performance
- 16-bit analog-to-digital converters

Steered CW

- 16-channel CW pulser to drive scanhead transducer
- 16-channel RF pre-amplifier for receiving signal
- TX/RX Beamformer for focusing when transmitting and receiving
- Mixer for basebend with 50 kHz range of right-angle phase (0 and 90 degrees)
- Thump filter (200/2 kHz)
- Variable Wall filter (Min. 200 Hz)
- Variable gain
- Variable lowpass filter with 1 kHz resolution for noise bandwidth performance
- 16-bit analog-to-digital converters

Figure 4-7 CW Block Diagram



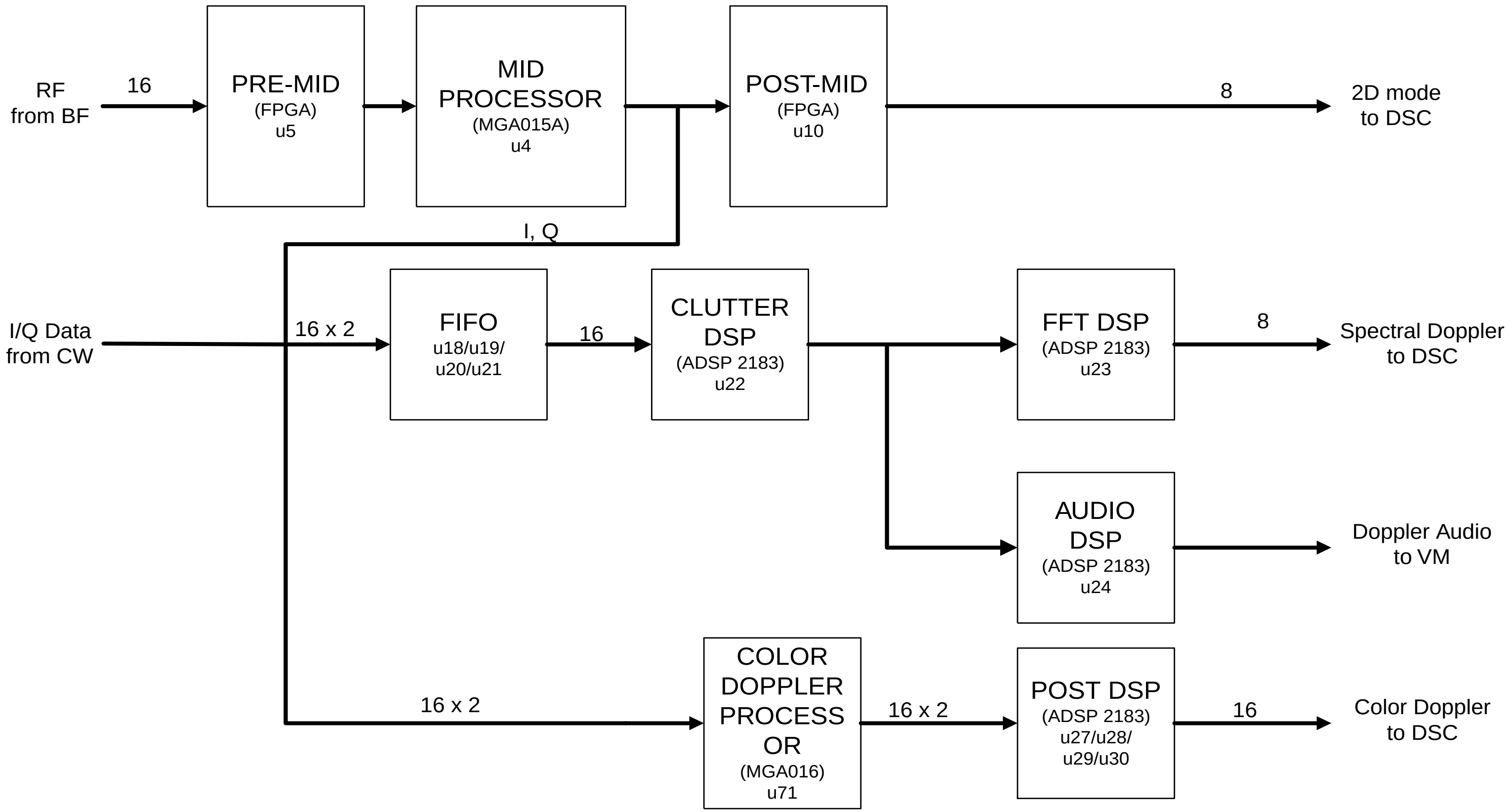
Digital Signal Processors (DSP)

Figure 4-8 is a simple block diagram of the DSP PCB. The RF data from the Beamformer PCBs is sent to the mid-processor via the bypass filter. While the RF data is going through the process of filtering and demodulation, it makes 2D-mode output and in-phase/quadrature-phase (I/Q) data. After adjusting the 2D-mode output gain, 2D-mode is output to the Digital Scan Converter (DSC) PCB.

I/Q data from the CW PCB is received and put through signal clutter filtering, Doppler, and audio processing. Doppler is sent to the DSC PCB and audio Doppler is sent to the Video Manager (VM) PCB.

I/Q data from the mid processor is further processed for Color Doppler image data. The Color Doppler processor provides signal clutter filtering and velocity estimation. The Post DSP then receives this Doppler and clutter data and carries out the process of flash artifact rejection, spatial filtering, and horizontal line interpolation before outputting the color Doppler image data to the DSC PCB.

Figure 4-8 DSP Block Diagram



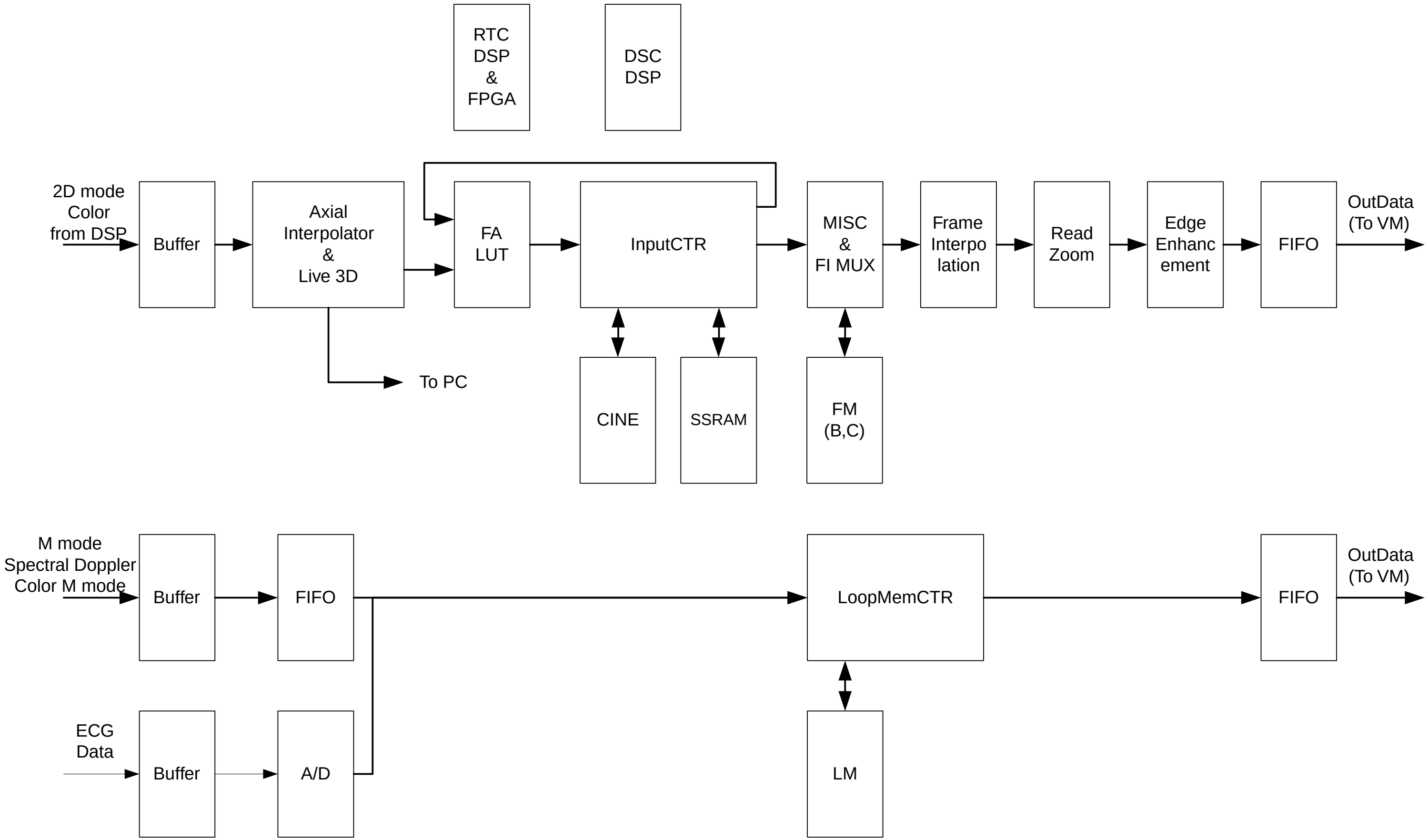
Digital Scan Converter (DSC)

Figure 4-9 is a functional diagram of the DSC PCB. Scan conversion is the process for mapping echo information into frame memory for displaying on the monitor. The DSC receives ECG data processed by the ECG PCB. Grayscale (2D, M, D) data and color data is received from the DSP for smoothing, edge enhancement, frame averaging, and line interpolation processing. The DSC maps data to frame memory according to an algorithm and sends image data to the Video Manager (VM).

Backplane

The Backplane (Motherboard) is the physical and functional “backbone” of the ultrasound engine. It is wired to the power supply (Figure 11-2) from which it receives DC operating voltages (Table 4-1) to distribute to the system components via a power bus and power cabling. The Backplane also provides control and signal interconnection (Figure 11-1) between the system components via data, computer, and control buses (Figure 4-1) and signal cabling. The Beamformer (BF0-BF3), Continuous Wave Doppler Processor (CW), Digital Signal Processors (DSP), Digital Scan Converter (DSC), Video Manager (VM), and Input/Output Panel PCBs are all plugged into connectors on the Backplane (Figure 13-2 and Figure 13-3).

Figure 4-9 Digital Scan Converter Block Diagram



Video Manager (VM)

The Video Manager provides video and audio development and routing. Figure 4-10 is a simple block diagram of the video support flow, and Figure 4-11 is a simple block diagram of the audio support flow. The VM PCB controls:

- Decoding CV and Y/C to RGB
- Image Grabber
- Interlace and Non-Interlace Video Output
- Digital Encoding (RGB to Y/C and CV)
- Stress Echo (Video Capture)
- Digital Video
- Video Color Keying
- Doppler Audio Processing
- Microphone Control
- Image & Stress Echo DMA Control

Figure 4-10 **VM: Video Support Block Diagram**

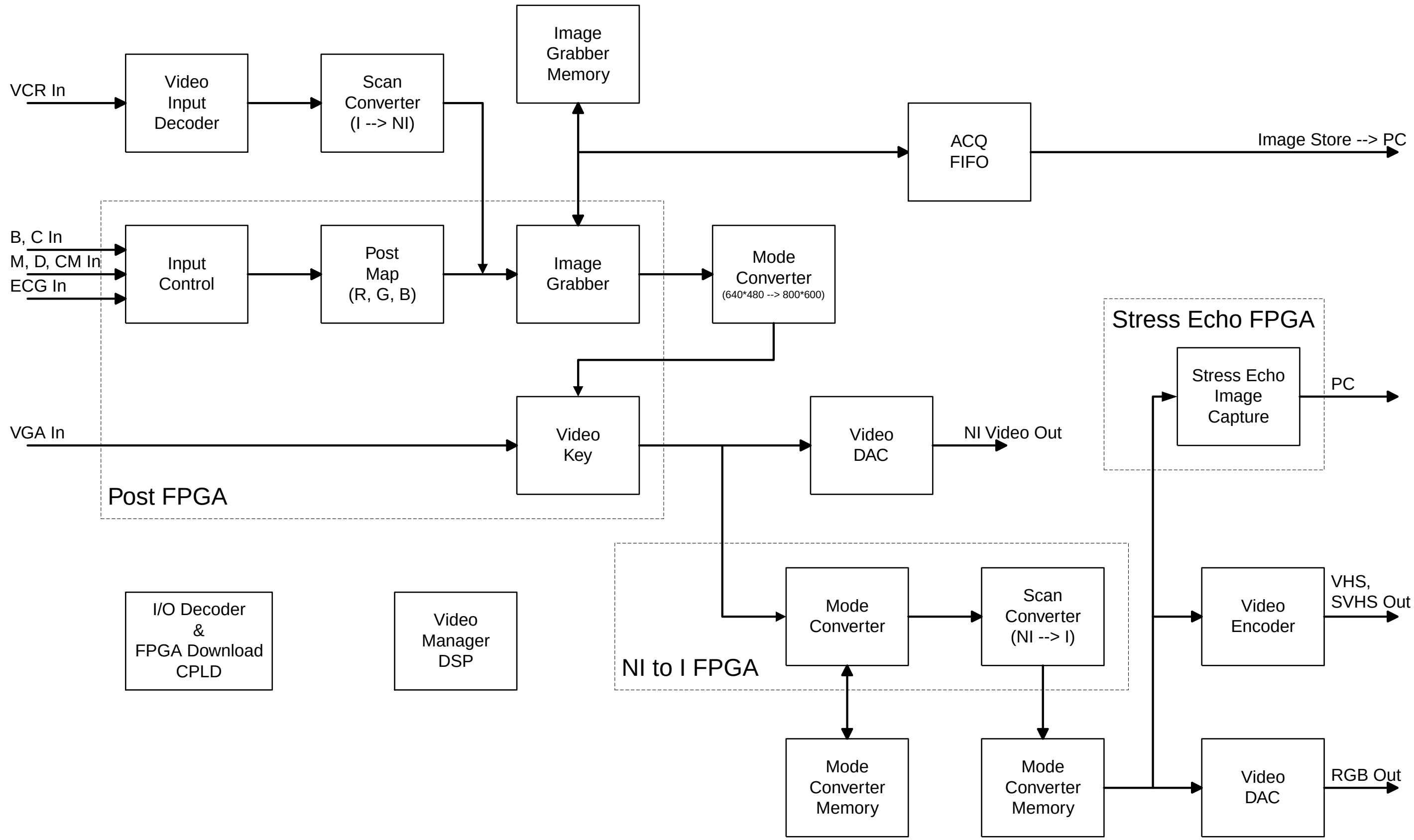
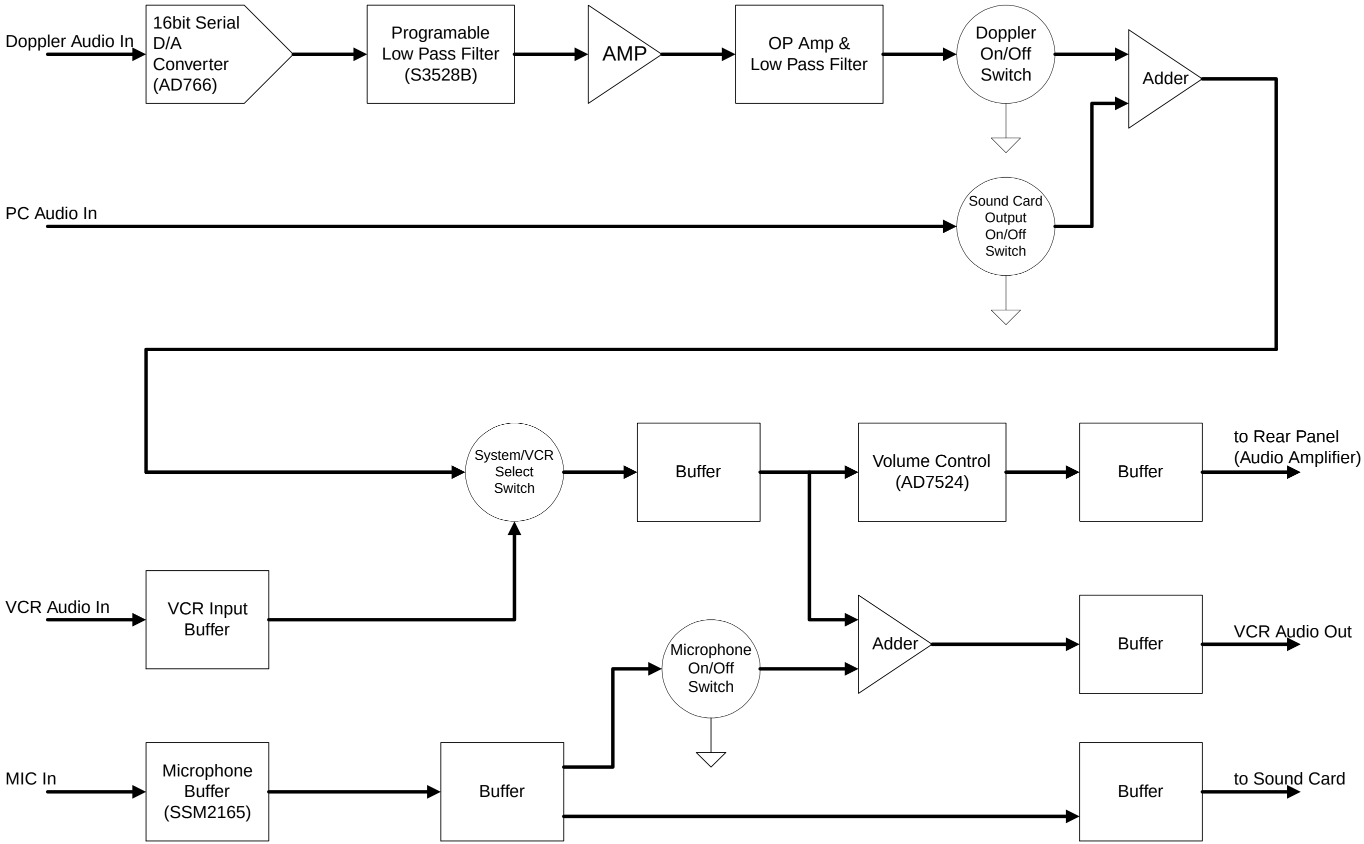


Figure 4-11 VM: Audio Support Block Diagram



Industrial PC Motherboard

The central processing unit of the system is the Industrial PC Motherboard, a Pentium processor CPU that is similar to the motherboard used in a personal computer. The Industrial PC Motherboard determines system functionality and coordinates the overall communication between the user and the system, which includes storing and saving images. The Industrial PC Motherboard communicates continually with the hard drive for operating parameters. See Table 4-2 through Table 4-10 for computer reference information. The Industrial PC Motherboard provides these primary functions:

- Pentium processor
- FD controller
- EIDE controller
- SVGA controller
- Ethernet controller
- Control logic
- Real-time clock
- USB port
- Sound card
- PC and digital subsystem interface
- Generates power-down sequence on command

Table 4-2 System Computer Settings

Setup Menus	Options
STANDARD CMOS SETUP (Table 4-3)	LOAD SETUP DEFAULTS
BIOS FEATURES SETUP (Table 4-4)	SUPERVISOR PASSWORD
CHIP FEATURES SETUP (Table 4-5)	USER PASSWORD
POWER MANAGEMENT SETUP (Table 4-6)	IDE HDD AUTO DETECTION
PNP/PCI CONFIGURATION (Table 4-7)	SAVE & EXIT SETUP
INTEGRATED PERIPHERALS (Table 4-8)	EXIT WITHOUT SAVING
ESC: Quit ↑↓→←: Select Item	
F9: Load Set Define F10:Save & Exit Setup	(SHIFT)F2:Change Color

Table 4-3 STANDARD CMOS SETUP Settings

Date (mm:dd:yy): Thu, Dec 27 2001

Time (hh:mm:ss): 15 : 03 : 27

	TYPE	SIZE	CYLS	HEAD	PRECOMP	LANDZ	SECTOR	MODE
Primary Master:	AUTO	0	0	0	0	0	0	AUTO
Primary Slave:	NONE	0	0	0	0	0	0	------
Secondary Master:	AUTO	0	0	0	0	0	0	AUTO
Secondary Slave:	AUTO	0	0	0	0	0	0	AUTO

Drive A: **NONE**	Base Memory: 640K
Drive B: **NONE**	Extended Memory: 261120K
Video: **LDC + CRT**	Other Memory: 384K
Halt On: All, But Keyboard	-------------------------
	Total Memory: 262144K

Esc: Quit ·®‡?: Select Item Pu/Pd/+/-: Modify

F1: Help (Shift) F2: Change Color

Table 4-4 BIOS FEATURES SETUP Settings

Virus Warning	: **Disabled**	Video BIOS	: **Enabled**
CPU Internal Cache	: **Enabled**	Shadow	: **Disabled**
External Cache	: **Enabled**	C8000-CBFFF	: **Disabled**
CPU L2 Cache ECG Checking	: **Enabled**	Shadow	: **Disabled**
Quick Power On Self Test	: **Enabled**	CC000-CFFF	: **Disabled**
Boot Sequence	: **C, A, SCSI**	Shadow	: **Disabled**
Swap Floppy Drive	: **Enabled**	D0000-D3FFF	: **Disabled**
Boot Up Floppy Seek	: **Enabled**	Shadow	
Boot Up Numlock Status	: **ON**	D4000-D7FFF	
Gate A20 Option	: **Fast**	Shadow	
Typematic Rate Setting	: **Enabled**	D8000-DBFFF	
Typematic Rate (Chars/Sec)	: **30**	Shadow	
Typematic Delay (Msec)	: **250**	DC000-DFFF	
Security Option	: **Setup**	Shadow	
OS Select For DRAM>64mb	: **Non-OS2**		
Report No FDD for WIN95	:**NO**		
Display PnP/PCI Device List	:**Yes**		
		Esc: Quit	·®‡?: Select Item
		F1: Help	Pu/Pd/+/-: Modify
		F5: Old Values	(Shift)F2: Color
		F6: Load BIOS Defaults	
		F7: Load Setup Defaults	

Table 4-5 CHIP FEATURES SETUP Settings

Auto Configuration	: **Enable**
EDO DRAM Speed Selection	: 60 ns
EDO CASx# NA Wait State	: 2
EDO CASx# Wait State	: 2
SDRAM RAS –to-CAS Delay	: 3
SDRAM RAS Precharge	: 3
SDRAM CAS Latency Time	: 3
SDRAM Precharge CONTROL	: Disabled
DRAM Data Integrity Mode	: Non-ECC
System BIOS Cacheable	: Disabled
Video BIOS Cacheable	: Disabled
Video RAM Cacheable	: Disabled
8 Bit I/O Recovery Time	: 3
16 Bit I/0 Recovery Time	: 1
Memory Hole At 15M-16M	: Disabled
Passive ReleaseDelayed	: Enabled
Delayed Transaction	: Disabled
Auto Detect DIMM CLK	: Enabled
	Esc: Quit ·®‡?: Select Item
	F1: Help Pu/Pd/+/-: Modify
	F5: Old Values (Shift)F2: Color
	F6: Load BIOS Defaults

Table 4-6 POWER MANAGEMENT SETUP Settings

Power Management	**: Disabled**	** Reload Global Time	Events **
PM Control by APM	**: Yes**	IRQ[3-7,9-15],NMI	**: Disabled**
Video Off Method	**: DPNS**	Primary IDE 0	**: Disabled**
Video Off After	**: Standby**	Primary IDE 1	**: Disabled**
MODEM Use IRQ	**: NA**	Secondary IDE 0	**: Disabled**
Doze Mode	**: Disable**	Secondary IDE 1	**: Disabled**
Standby Mode	**: Disable**	Floppy Disk	**: Disabled**
Suspend Mode	**: Disable**	Serial Port	**: Enabled**
HDD Power Down	**: Disable**	Parallel Port	**: Disabled**
Throttle Duty Cycle	**: 62.5%**	Esc: Quit ↑↓→← : Select Item	
PCI/VGA Act-Monitor	**: Disabled**	F1: Help Pu/Pd/+/-: Modify	
Soft-Off by PWR-BTTN	**: Instand-Off**	F5: Old Values (Shift)F2: Color	
CPUFAN Off in Suspend	**: Enabled**	F6: Load BIOS Defaults	
PowerOn by Ring	**: Disabled**	F7: Load Setup Defaults	
IRQ8 Break Suspend	**: Disabled**		

Table 4-7 PNP/PCI CONFIGURATION Settings

PnP OS Installed	**: No**	Onboard VGA IRQ	**: Auto**
Reset Controlled by Data	**: Disabled**	PCI DMAC IRQ	**: Auto**
Reset Configuration by	**: Auto**	Onboard LAN IRQ	**: Auto**
		Onboard SOUND IRQ	**: Auto**
		USE IRQ	**: Auto**
		Esc: Quit ↑↓→← : Select Item	
		F1: Help Pu/Pd/+/-: Modify	
		F5: Old Values (Shift)F2: Color	
		F6: Load BIOS Defaults	
		F7: Load Setup Defaults	

Table 4-8 INTEGRATED PERIPHERALS Settings

IDE HDD Block Mode	: **Enabled**	Onboard FDD Controller	:**Enabled**
On-Chip Primary PCI IDE	: **Enabled**	Onboard Serial Port1	:**3F8/IRQ4**
Primary Master PIO	: **Auto**	Onboard Serial Port2	:**2F8/IRQ3**
Primary Slave PIO	: **Auto**	Serial Port2 Mode	:**Normal**
Primary Master UDMA	: **Auto**	Onboard Serial Port3	:**3E8/IRQ12**
Primary Slave UDMA	: **Auto**	Onboard Parallel Port	:**378/IRQ7**
On-Chip Secondary PCI IDE	: **Enabled**	Parallel Port DMA	:**ECP+EPP**
Secondary Master PIO	: **Auto**	ECP Mode Use DMA	:**3**
Secondary Slave PIO	: **Auto**	EPP Mode Select	:**EPP1.9**
Secondary Master PIO	: **Auto**	USB Keyboard Support	:**Disabled**
Secondary Slave PIO	: **Auto**	Video Font Expansion	:**Enabled**
		Esc: Quit ↑↓→← : Select Item	
		F1: Help Pu/Pd/+/-: Modify	
		F5: Old Values (Shift)F2: Color	
		F6: Load BIOS Defaults	
		F7: Load Setup Defaults	

Table 4-9 I/O Device Port Address Map

ADDRESS	DEVICE
000-01F	DMA CONTROLLER#1
020-03F	INTERRUPT CPNTROLLER #1
040-05F	TIMER
060-06F	KEYBOARD CONTROLLER
070-07F	REAL TIME CLO
080-08F	INTERRUPT CONTROLLER #2
0F0	CLEAR MATH COPROCESSOR SINGAL
0C0-0DF	DMA CONTROLLER #2
0F1	RESET MATH COPROCESSPR
0F8-0FF	MATH COPROCESSPR
120	DISABLE WATHCDOG TIME OPERAQTION(READ)
121	ENABLE WATCHDOG TIME OPERATION(READ)
122	WATCHDOG
1F0-1F8	FIXED DISK CONTROLLER
200-207	GAME PORT
300-31F	PROTOTYPE CARD
360-36F	RESERVED
378-37F	PARALLEL PORT
380-3F8	SDLC #2
SA0-3AF	SDLC#1

Table 4-9 I/O Device Port Address Map (Continued)

ADDRESS	DEVICE
3F0-3F7	FLOPPY DISK CONTROLLER
2F8-3FF	SERIAL PORT #1(COM1)
2F8-2FF	SERIAL PORT #2(COM2)
3F0	WINBOND I/O

Table 4-10 Interrupt Controller NMI Assignments

NMI	Assigned to
IRQ0	SYSTEM TIMER OUTPUT
IRQ1	KEYBOARD
IRQ2	INTERRUPT REROUTING FROM IRQ8 THROUGH IRQ15
IRQ3	SERIAL PORT #2
IRQ4	SERIAL PORT #1
IRQ5	RESERVED
IRQ6	FLOPPY DISK CONTROLLER
IRQ7	PARALLEL PORT #1
IRQ8	REAL TIME CLOCK
IRQ9	RESERVED
IRQ10	RESERVED(ONBOARD SCSI)
IRQ11	USB AND[ONBOARD NETWORK]
IRQ12	PS/2 MOUSE

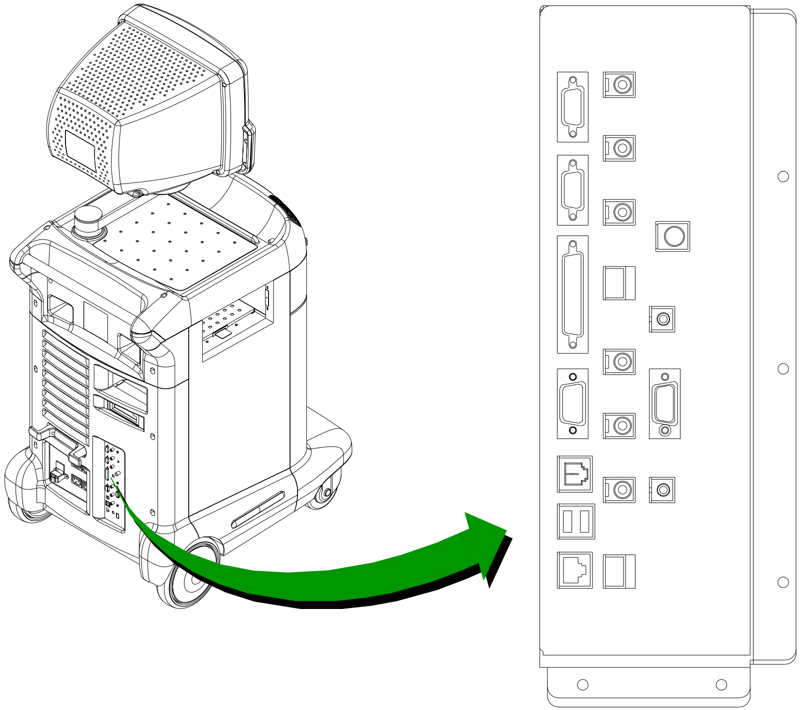
Table 4-10 Interrupt Controller NMI Assignments (Continued)

NMI	Assigned to
IRQ13	MATH COPROCESSOR
IRQ14	PRIMARY IDE CHANNEL
IRQ15	SECONDARY IDE CHANNEL

Input/Output Panel

The I/O Panel at the rear of the system (Figure 4-12) is made up of three PCBs (Figure 14-25) that accomplish the interconnection between system components and peripheral devices.

Figure 4-12 Rear I/O Connector Panel



User Interface

The user interface comprises the controls, indicators, and output devices of the system.

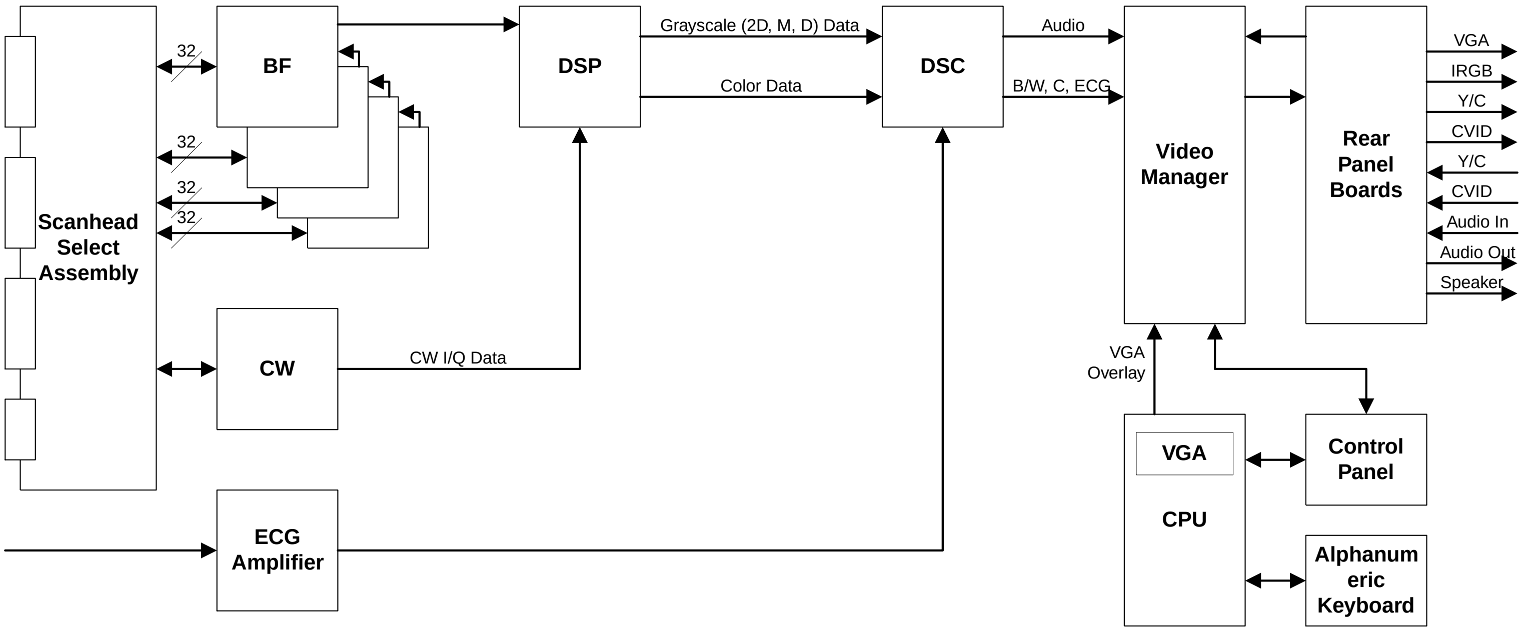
The control panel (in conjunction with the monitor displays) is the primary operating interface with the ultrasound system. The footswitch, with freeze and display change functions, is an extension of the control panel.

The control panel (Figure 1-3, Figure 1-4) consists of TGC slide pot controls, trackball, additional system control knobs and buttons, and a QWERTY keyboard. An internal interface PCB reads all of the control inputs, determines the function that has been selected, and transmits that information to the Industrial PC Motherboard for processing.

Data Paths

Figure 4-13 is a diagram of the system 2D, M-mode, Doppler, and color data paths.

Figure 4-13 Data Path



5 Installation

Introduction

This section contains pre-installation and installation information for the HDI 4000 system. On-site installation usually consists of uncrating, unpacking, installing the monitor and accessories, checking connections, and powering up the system for a functional check. Read this section completely before starting the installation.

Pre-Installation Evaluation

Before the system is delivered, Philips recommends that you perform the following pre-installation evaluations.

Checking Physical Access for Delivery, Installation, and Operation

➤ **To check that the site is prepared for system installation**

1. With the customer, evaluate site access for delivery. Consider the availability of a loading dock, elevators, ramps, and the width of passageways and doors.
2. Verify that there is adequate space available for system uncrating and installation.
3. At each location where the system will be operated, verify that there is enough space for the system and any external peripherals.
4. Check adjacent rooms for activity and types of equipment that might negatively affect the Philips Ultrasound system.

NOTE Avoid placing the system in environments for operation or storage where the equipment is exposed to water vapor, direct sunlight, high humidity, salty atmosphere, and chemicals or gas.

Checking the Operating Environment

Advise the appropriate facility representative of system environmental operating requirements, including proper ventilation. If the rooms where the system will be used seem excessively hot or humid to you, ask the facility representative to take measurements. If they are not within system environmental operating specifications, ask the facility representative to make the appropriate corrections.

Wiring Requirements

Philips recommends that the electrical feeds to the system each be a dedicated line (no other equipment on the same line) with a third-wire ground. The ground wire shall be an insulated, isolated solid copper conductor bonded to the ground bus of the service panel. The outlet shall be a Hospital Grade Receptacle (for installations in North America) or an Isolated Ground Receptacle. Proper installation shall reflect compliance with the national electrical code, or the appropriate governing agency.

Checking the Electrical Power Source

WARNING

For safety and liability reasons, do not disassemble any power outlet or open any electrical panel. Have the facility representative confirm wiring compliance with the criteria specified below.

➤ To verify a dedicated AC line

1. Explain to the facilities representative that the system requires a dedicated AC line meeting the electrical power requirements identified in “Specifications” on page 37.

2. Verify that the outlet to be used is a dedicated line.
   a. Have the facility representative open the circuit breaker corresponding to the AC line for the system.
   b. Confirm that power is still applied to all other outlets and hard-wired devices in the immediate area and that power is removed only from the dedicated outlet.
3. Verify the proper wiring of the outlet. Also test for the presence of a ground and if equipped to do so, try to verify that neutral and ground are not reversed.
4. Review with the facility representative the current draw of the system and the voltage range it requires. It is the responsibility of the facility representative to determine the proper size of the wire based upon the length of the feed.
5. Measure the hot/neutral, hot/ground, and neutral/ground voltages with a comparable load (for example, another ultrasound system) on the line.
6. Determine line loss.
   a. Have the facility representative measure the voltage at the primary of the line's circuit breaker in the distribution sub-panel. If a facility representative is not available go to step c.
   b. Measure the voltage at the wall outlet. Calculate the percentage of voltage loss across the line using this formula:

      Percent line loss = [(A-B)/A] x 100

      where A is the voltage at the circuit breaker with the system on, and B is the voltage at the wall outlet with the system on.
   c. If a facility representative is not available, measure the voltage at the outlet with the load on and then with the load off.

d. Calculate the percentage of voltage loss across the line using this formula

Percent line loss = [(A-B)/A] x 100

where A is the voltage at the wall outlet with the system off, and B is the voltage at the wall outlet with the system on.

7. If you are equipped and trained to do so, measure the power line noise. Repeat with a load applied, for example, another ultrasound system.
8. Record your power quality observations and measurements.
9. Affix a Power Line Data sticker to the most qualified outlet in each of the primary operating areas. Add the circuit breaker number and location.

Checking for Electrostatic Discharge

During system operation and maintenance, electrostatic discharge (ESD) can cause system lock-ups, equipment reliability problems, and component failures.

CAUTION

With system covers or shields removed, ESD *will always* cause component damage. ESD damage is cumulative and may not be apparent at first, as indicated by a hard failure, but can cause degraded performance. Therefore, always use proper ESD handling procedures.

ESD results from a difference in electrical potential equalizing. ESD is more prevalent in low humidity and when there is friction against carpeting, linen, and clothing. Avoid placing the system directly under or close to HVAC vents. While special equipment is required to measure ESD levels, you can determine the presence of ESD as follows:

- Check for the presence of ESD by walking around where the system will be installed and touching grounded surfaces. Note if you experience static discharges in the area.

- Ask the operators if they have experienced static discharges in the work area.
- If ESD is evident, suggest possible ESD minimizing devices and their usage, for example, static mats, humidifiers, and sprays.

System Installation

The following paragraphs contain system installation procedures. After you have completed the physical system installation and initial setup, verify that the system operates correctly using tests from “Performance Tests” on page 119. Read this section completely before starting system installation.

Preliminary Inspection

➤ To inspect the shipping crate for signs of damage

1. Inspect the shipping crate before unpacking the system, examining it for any damage. Look for evidence that might indicate that the crate was opened.
2. Inspect tilt and shock indicators on the outside of the shipping crate to ensure that they are not indicating RED. If the indicators show RED, the system needs to be inspected and tested to determine if it was damaged in shipment.
3. Report any damage or pilferage to the carrier, the customer, and the Philips traffic department.

Unpacking the System

➤ To unpack the system shipping crate

1. Inspect the shipping crate before unpacking the system (Figure 5-1).
2. Ensure that you have sufficient space to unpack the system.

WARNING

Use caution when removing the strapping bands securing the shipping crate. These bands are under enough tension to cause injury if removed carelessly.

3. Remove (cut) the strapping bands from around the crate carton.

4. Remove the carton top cover from the shipping crate.
5. Cut the taped edges of the carton, and carefully remove the carton from around the system.

NOTE Look for the label side that says, “OPEN THIS SIDE”.

6. Carefully remove the interior foam cushioning and any other packing materials (Figure 5-2).
7. Remove the monitor, hard disk drive, and accessory kit cartons from the crate and carefully set aside.

WARNING Remove the two 9/16-inch bolts securing the front section of the inner crate to the pallet. This piece also serves as a ramp.This system weighs approximately 101 kg (222 lbs). To avoid possible personal injury or damage to equipment, do not attempt to lift the system without assistance. Also, use care when moving the system to avoid injuring yourself and damaging the equipment.

➤ To remove the system from the crate

1. Position the tall end of the ramp so that it butts up against the pallet at the rear of the system, with the beveled end of the ramp sloping to the floor.
2. Remove the chock from behind the rear wheels. If the brakes are locked, release them.
3. Carefully pull the system off of the pallet and down the ramp.
4. Carefully remove the monitor from its packaging and set it safely aside.
5. Open any accompanying boxes, locate and unwrap the contents, and set everything safely aside.
6. Properly dispose of the shipping materials. Do not return these materials to Philips.

Figure 5-1 Shipping Crate Components

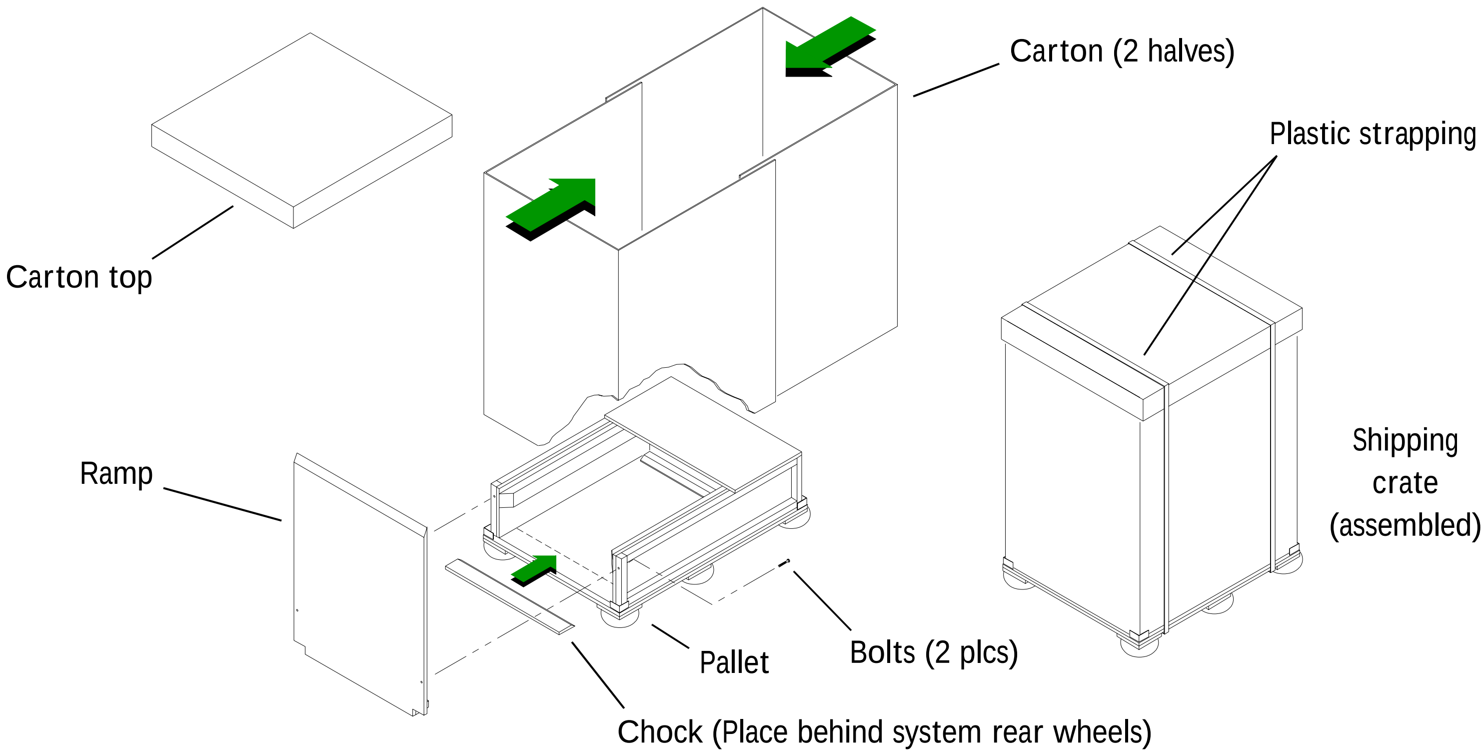
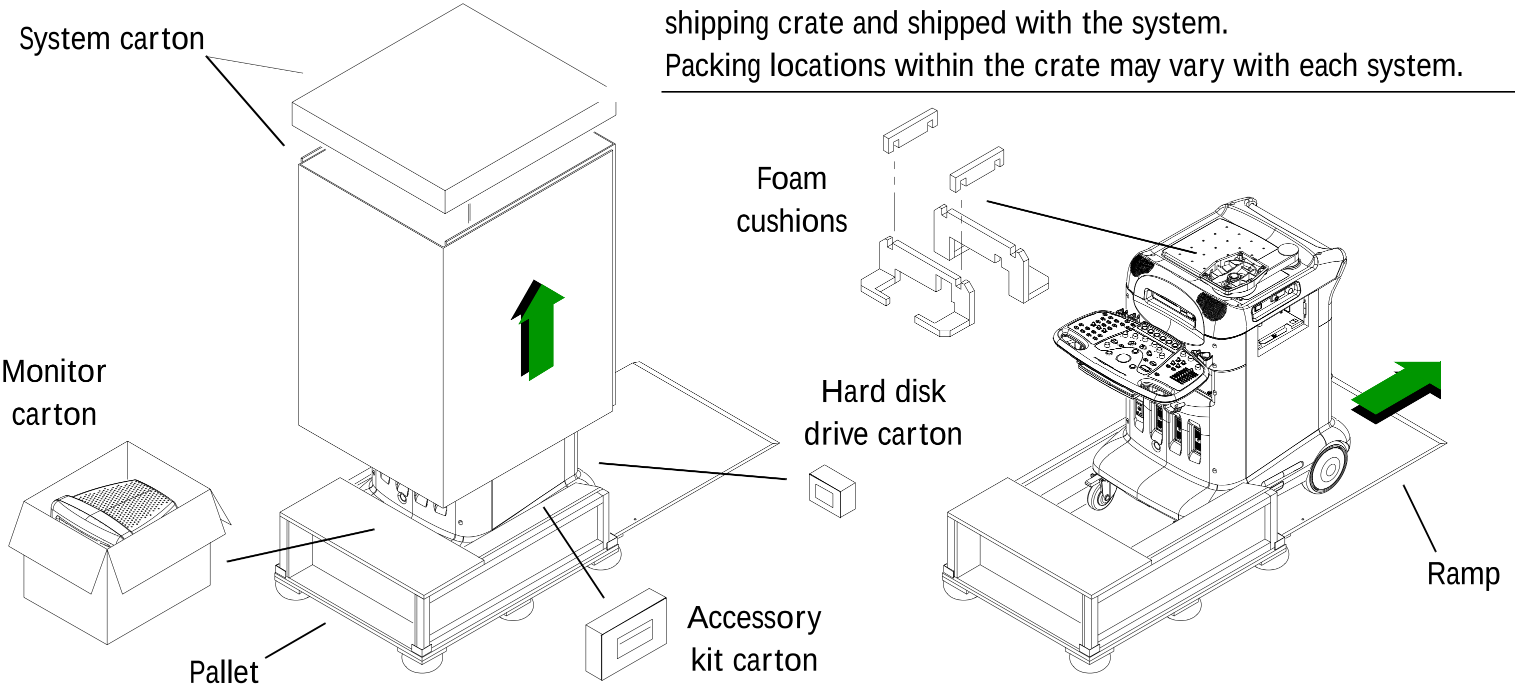


Figure 5-2 Unpacking the Shipping Crate

NOTE The monitor, HDD, and accessory kit cartons are placed inside the shipping crate and shipped with the system.
Packing locations within the crate may vary with each system.



General Inspection

➤ Inspection

1. Inventory the shipment against the packing list.
2. Inspect the video monitor, scanheads, and accessories for damage.
3. Inspect the outside surfaces of the system for damage.
4. Report any damage to the carrier, the customer, and the Philips traffic department.
5. Verify that the system rolls and turns smoothly on its casters.

CAUTION

This equipment contains components that are electrostatically sensitive. Proper antistatic procedures, protection, and equipment must be used prior to opening and during handling of this equipment. Failure to use ESD procedures *will* cause damage to these components. Such damage to components is *not* covered by Philips warranties.

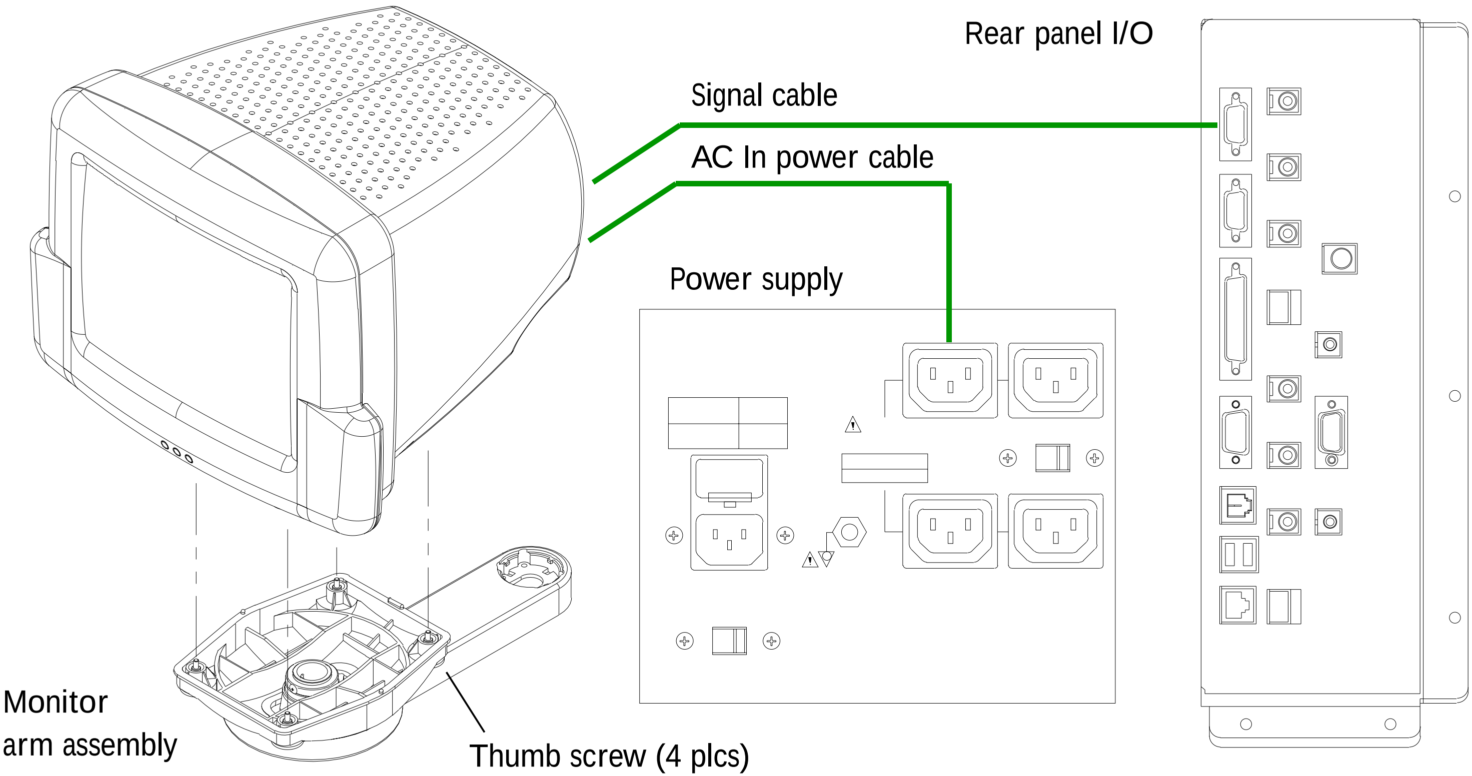
6. Remove the system covers.
7. Remove any loose packing material, dust, or debris from the system interior.
8. Verify that all visible cable connections are correct and secure.
9. Verify all modules are secure.
10. Seat and tighten modules and connectors as necessary.
11. Install the system covers.

Installing the Monitor

➤ To install the system monitor

1. Note the location of the monitor aligning slot and pin holes and the four thumbscrew receiving nuts on the bottom of the monitor (Figure 5-3).
2. Carefully place the monitor on the monitor mounting plate, positioning it so that the aligning tab and pins on the monitor mounting plate mate with the aligning slot and pin holes on the monitor.
3. Thread the thumbscrews into the receiving nuts until finger-tight and the monitor is secure.
4. Connect the video and power cables at the back of the monitor, dressing the cables as needed.
5. Verify that the monitor tilts and swivels correctly on its base.

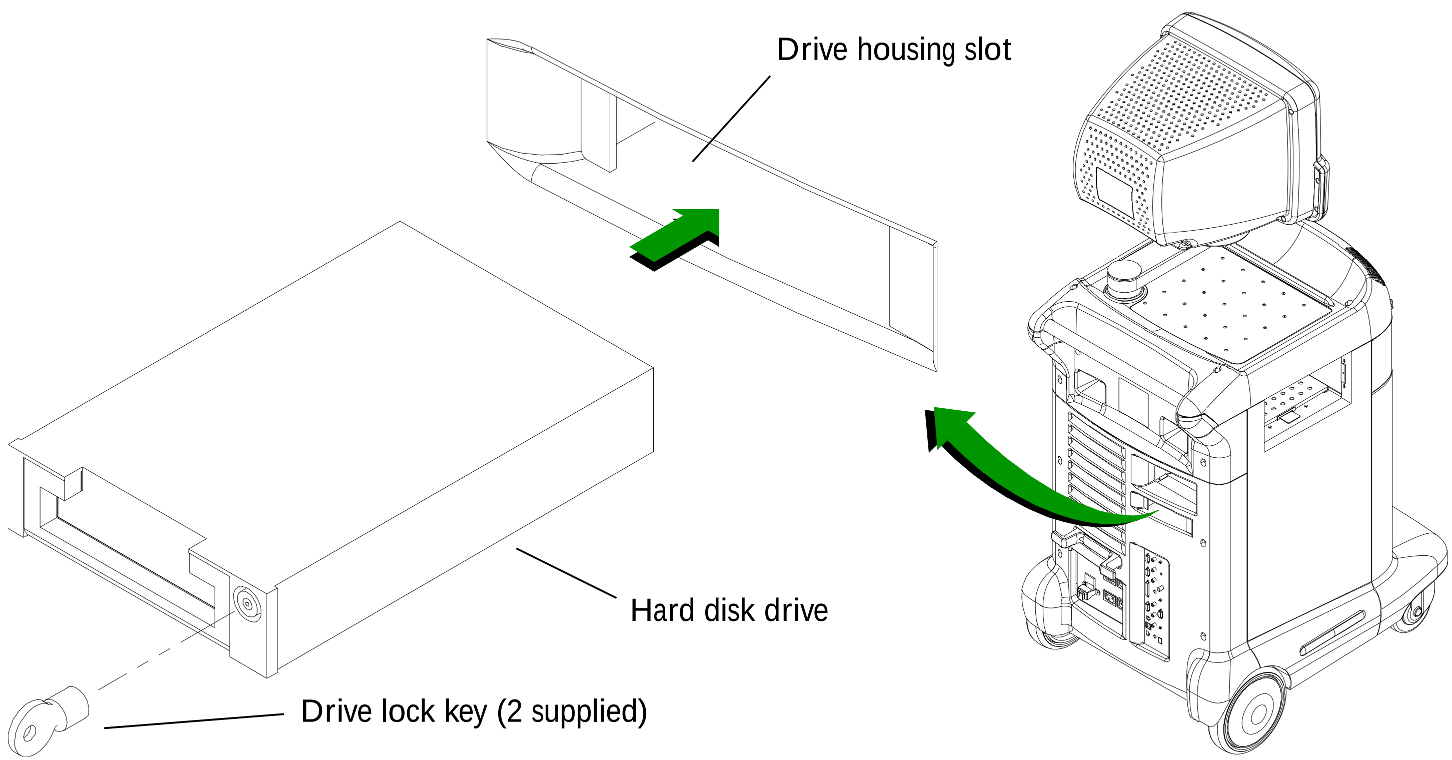
Figure 5-3 **Monitor Installation**



Installing the Hard Disk Drive (HDD)

After unpacking the hard disk drive (HDD) from its separate packaging (Figure 14-34), slide it into the drive housing slot at the rear of the system and lock it in place with the key (Figure 5-4). Two keys are supplied with the drive assembly (Figure 14-34). Store the keys in a safe place.

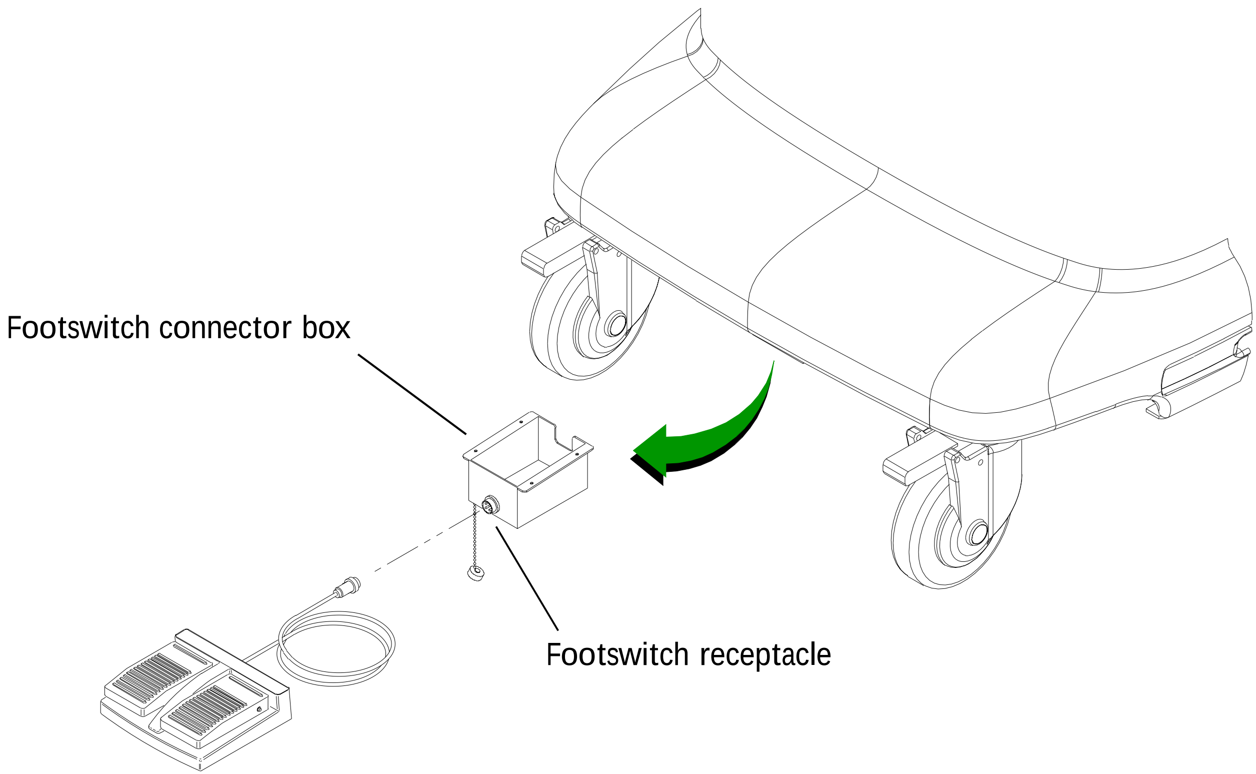
Figure 5-4 Hard Disk Drive Installation



Installing the Footswitch

Connect the footswitch cable to the system footswitch connector on the lower front panel (Figure 5-5). The footswitch is packaged with the accessory kit (Figure 14-35).

Figure 5-5 Footswitch Connection



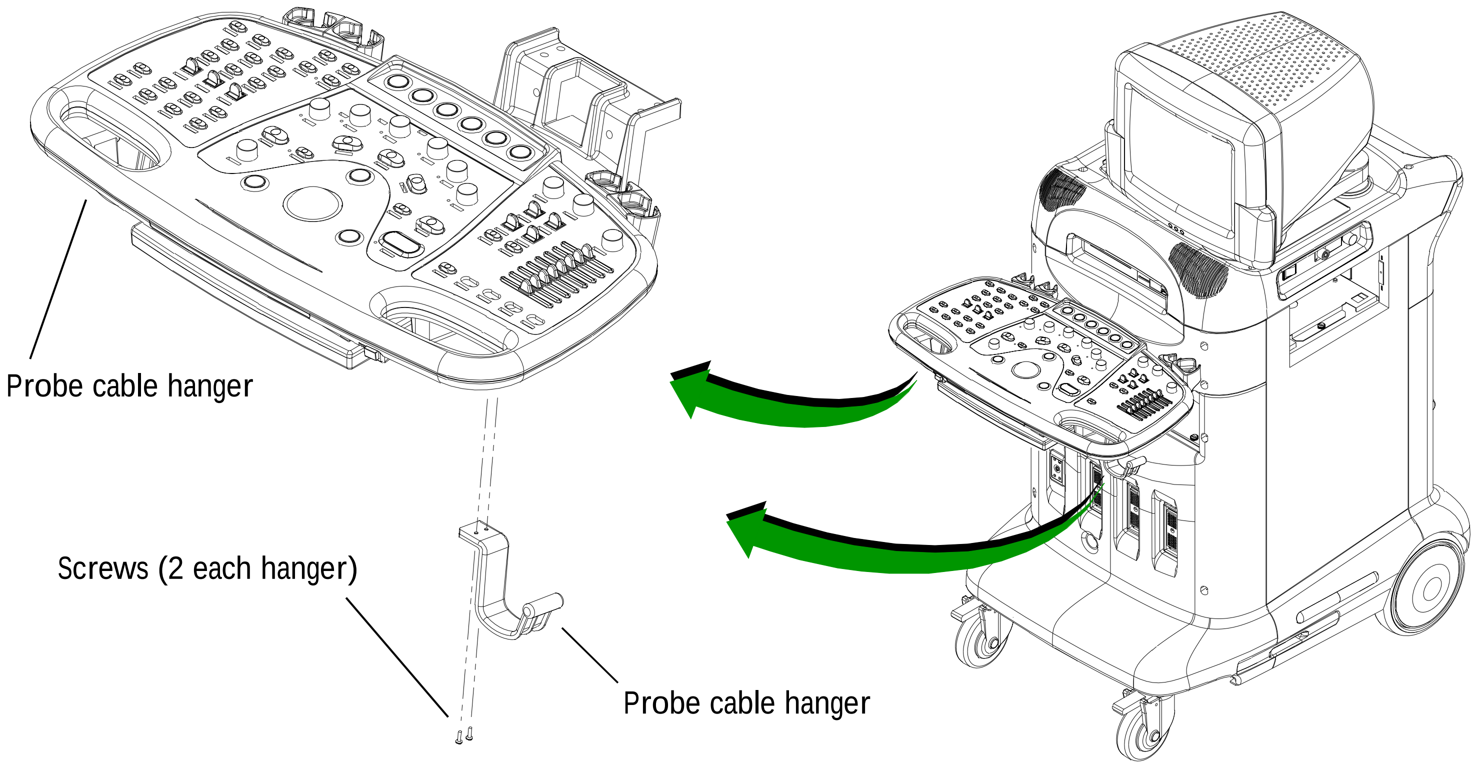
Installing the Probe Cable Hangers

➤ To install the probe cable hangers

NOTE The probe cable hangers are removed for shipping so the system will fit properly within the crate. The cable hangers and screws are packaged with the accessory kit (Figure 14-35) and are stored inside the shipping crate (Figure 5-2).

- Attach the two probe cable hangers to the underside of the control panel using the four screws (two per hanger) supplied (Figure 5-6).

Figure 5-6 **Probe Cable Hangers Installation**



Setting Up the System

➤ **To set up the system**

1. If not already done, verify proper dedicated line wiring and voltage levels (see “Checking the Electrical Power Source” on page 82).
2. Before turning system power on, confirm that the power configuration of the system is compatible with the AC power source. If peripheral equipment is installed, check that the output voltage and current setting of the peripheral power outlets is compatible with the power configuration of the peripherals.

CAUTION

As shipped from the factory, the input voltage switch has a “switch position retaining clip” that is held in place by one of the two input voltage switch mounting screws. When changing the setting, you will need to remove the screw securing the clip, change the setting, and install the clip on the opposite side using the other screw. Do NOT remove both screws for the switch at the same time or the switch will fall back into the Power Supply.

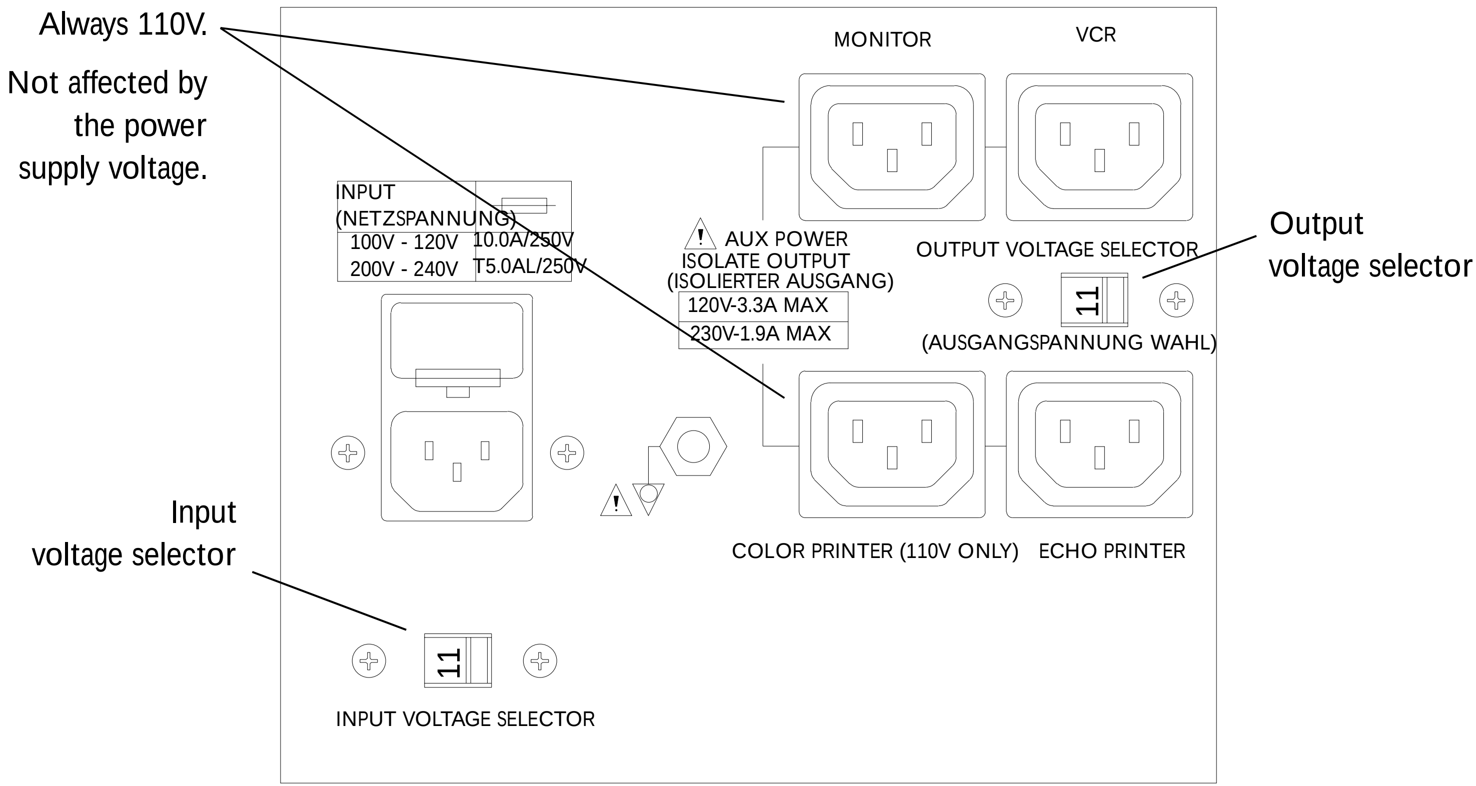
a. Locate the two red output voltage selector switches on the rear of the power supply AC connector panel (Figure 5-7).
b. Verify that the switch is set to the correct system AC source voltage (115 or 230) for the installation site. If you need to change the setting, do so only after reviewing the CAUTION above.
c. Verify that the switch is set to the correct system AC source voltage (115 or 230) for the peripherals installed.

NOTE The two AC power connectors (labeled ***MONITOR*** and ***COLOR PRINTER (110V ONLY)*** are unaffected by the power supply voltage configuration switch settings and are always 110 volts AC.

WARNING Do not plug in the system if a wiring fault is discovered. Advise the customer immediately, and proceed only after the fault has been corrected.

3. Connect the system AC power cord.
4. Connect the system scanheads.
5. Turn on system power and verify that the fans are operating.

Figure 5-7 **AC Power Selection**



6. Verify that the first MO disk to be used in the system is formatted. (An MO disk must be formatted to be used in the system. The system will not recognize an unformatted MO disk.) An MO formatting utility is included in the system software.
7. If the system DICOM features will be used, set up the system for DICOM operation as described in “To configure the HDI 4000 system for DICOM operations” on page 100.
8. Verify system setup.
   a. Set the VCR Video Format to match the Customer Order Acknowledgement (COA).
   b. Verify that the System Software version matches the COA.
   c. Verify that the Serial Port is set for **Panasonic MD830**.
   d. Verify or set the correct date and time.
   e. Verify or set the System Language to your customer’s choice (see “Language Settings” on page 116).
   f. Set the Left Footswitch for Update and the Right Footswitch for Freeze.
   g. Verify or enter the feature option passwords in accordance with the COA.
   h. Verify that the Windows 2000 keyboard language matches the Control Panel language (see “Language Settings” on page 116).
9. Verify or set the Monitor settings. (Adjusting the Totoku monitor display size so that the display fills the screen has been known to reduce image resolution). See “Adjustments” on page 137 for nominal monitor settings.
10. Run the Diagnostics **All Information** option (see “Running the System On-Board Diagnostics” on page 155) and verify a pass condition for all items in the Results summary.
11. Exit Diagnostics and reboot the system.
12. Cycle System power.

➤ To configure the HDI 4000 system for DICOM operations

NOTE This and other connectivity information can also be found at the *Connectivity* link on the Philips Ultrasound Customer Service intranet web site (http://service.btl.ms.philips.com).

Before beginning this procedure, consult with your customer or the customer's system administrator to determine the following information:

- Administrator Mode password
- HDI 4000 system IP address, subnet mask, and gateway address
- IP addresses of the network devices to which the system will send or print images
- Application Entity (AE) Title and port numbers for each destination device (consult the vendor's DICOM Conformance Statement or technical support personnel for this information)

You will not be ready to proceed until you have all of this information. The DICOM features will not work properly if the information is wrong or incorrectly entered (AE Titles are case-sensitive and the Host Name must be identical in spelling and syntax to the Host Name entered in the Hosts file). Connect only to the devices that appear on the latest Philips DICOM Compatibility List.

1. Configure the internet protocol:
   a. Press **SETUP**. The setup menu appears.
   b. Select **DICOM**. The DICOM settings screen appears (Figure 5-8, Figure 5-9).
   c. Click **Network Config**. The password dialog appears.
   d. Enter the password, and then click **OK**. The network connection dialog box appears (Figure 5-10). If you do not know the password, contact your local Philips technical support group.

Figure 5-8 **DICOM Settings Screen - No Services** (see also Figure 5-9)

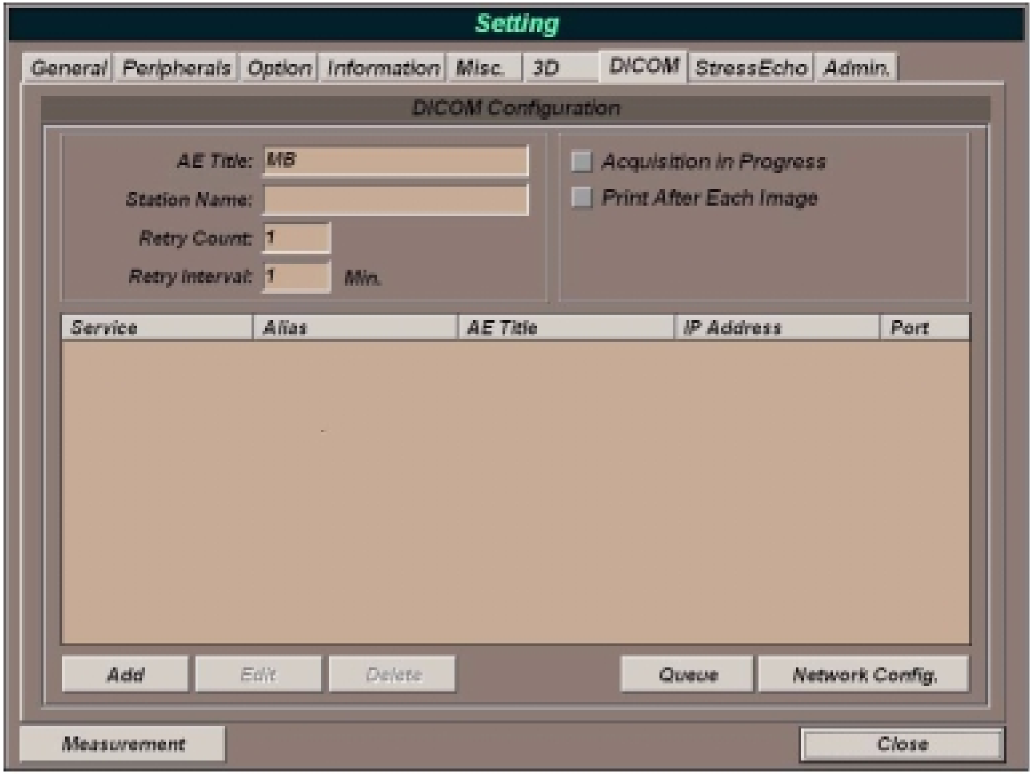
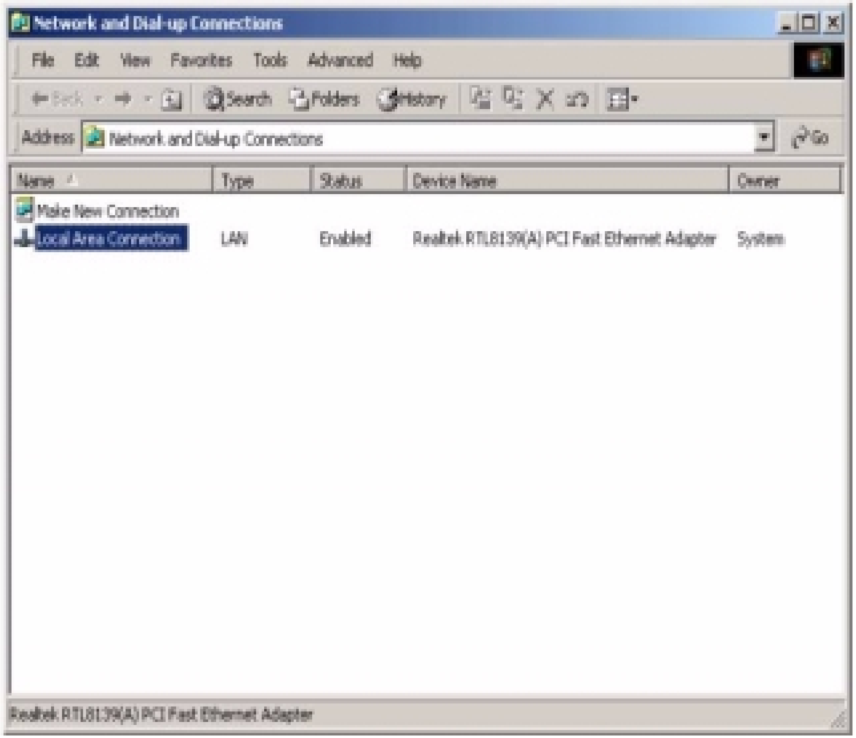


Figure 5-9 DICOM Settings Screen With Server Entries

Figure 5-10 Network and Dial-up Connection Selection



e. Double-click **Local Area Connection**. The Local Area Connection Status dialog box appears.

f. Click **Properties**. The Local Area Connection Properties dialog box appears (Figure 5-11A).

g. Select **Internet Protocol (TCP/IP)** and then click **Properties**.The Internet Protocol TCP/IP Properties dialog box appears (Figure 5-11B).

h. Click **Use the following IP address** and do one of the following:

- For a local area connection, in the **IP address, Subnet mask**, and **Default gateway** fields, type the IP address, subnet mask, and default gateway addresses.
- For all other connections, in the **IP address** field, type the IP address.

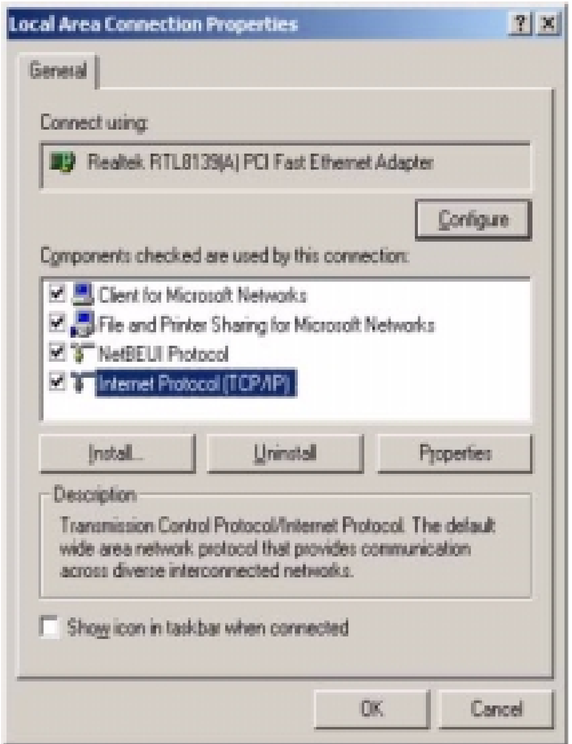
i. If not already selected, click **Use the following DNS server addresses**.

j. In **Preferred DNS server** and **Alternate DNS server**, type the primary and secondary DNS server addresses.

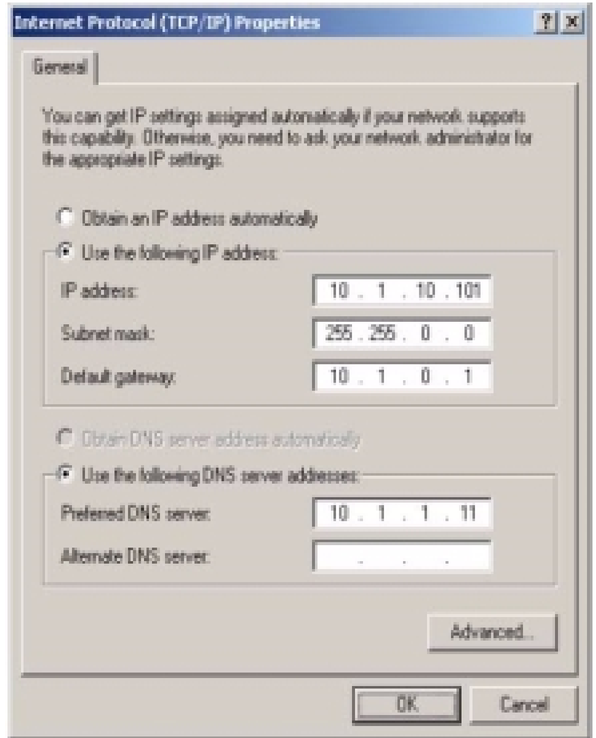
k. Click **OK** and reboot the system.

l. Verify the IP information (see “To test the system IP configuration” on page 176).

Figure 5-11 Local Area Connection and TCP/IP Properties



A - Local Area Connection



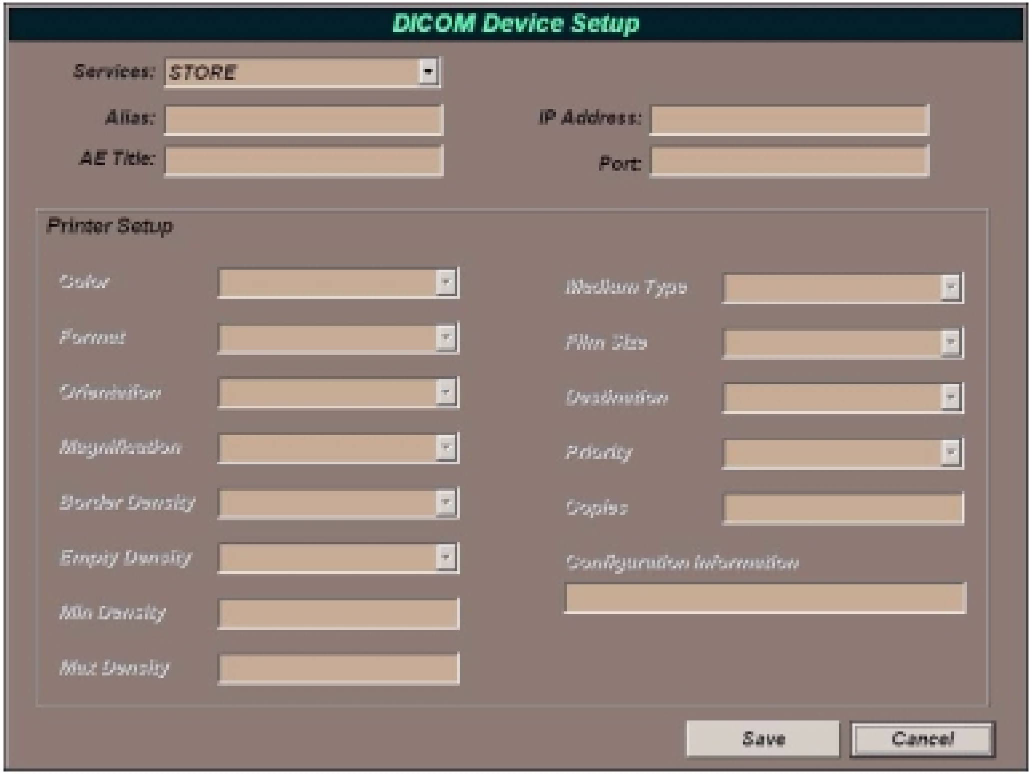
B - Internet Protocol (TCP/IP) Properties

2. Enter the system DICOM settings:
   a. Press **SETUP**. The setup menu appears.
   b. Select **DICOM**.The DICOM settings screen appears (Figure 5-8).
   c. Fill in the AE Title, Station Name, Retry Count and Retry Interval.
      - AE Title: The device's application entity title, as provided by the Network System Administrator.
      - Station Name: The name for the HDI 4000.
      - Retry Count: Number of times to try again when transfer failed.
      - Retry Interval: The time in minutes between trying again.
   d. Select **Acquisition in Progress** to turn on automatic transmission of images. If you want to disable the automatic sending of images, de-select **Acquisition in Progress**.
   e. Select **Print After Each Image** to turn on automatic printing of images. If you want to disable the automatic printing of images, de-select **Print After Each Image**.
3. Add or edit a storage, printer, or modality worklist server as necessary.

➤ To add a storage server

1. Press **SETUP**. The setup menu appears.
2. Select **DICOM**. The DICOM settings screen appears (Figure 5-8).
3. Click **Add**.
4. Select **STORE** from the Services drop-down list. The Storage Server settings screen will appear (Figure 5-12).

Figure 5-12 Storage Server Settings Screen

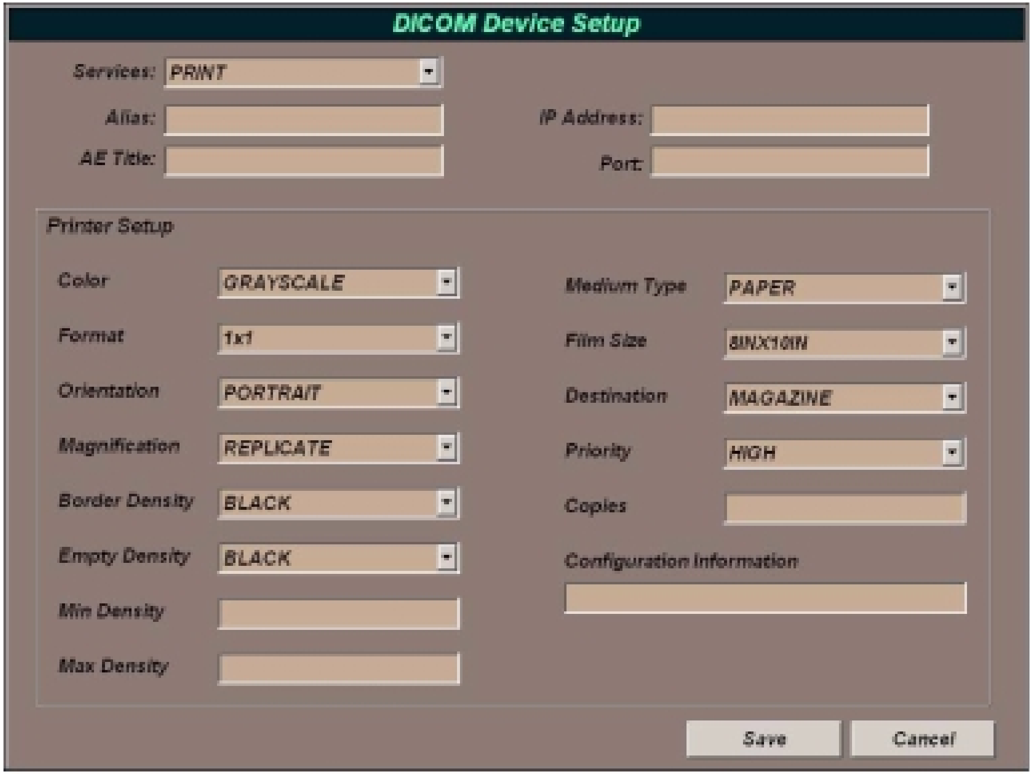


5. Enter the Alias, AE Title, IP Address, and Port number of the destination:
   - Alias: Each device on the network requires an alias. The alias is an arbitrary name that describes the device.
   - AE Title: A unique name assigned to a device for purposes of DICOM communication.
   - IP Address: The device's IP address as provided by the network system administrator.
   - Port Number: The port for each device is found in the vendor's DICOM Conformance Statement.
6. Click **Save** to store settings.

➤ To add a printer

1. Press **SETUP**. The setup menu appears.
2. Select **DICOM**. The DICOM settings screen appears (Figure 5-8).
3. Click **Add**.
4. Select **PRINT** from the Services drop-down list. The Printer settings screen will appear (Figure 5-13).
5. Fill in Alias, AE Title, IP Address and Port number of the destination.
6. Set the printer setup parameters.
7. Click **Save** to store the settings.

Figure 5-13 Printer Settings Screen



➤ To add a modality worklist server

1. Press **SETUP**. The setup menu appears.
2. Select **DICOM**. The DICOM settings screen appears (Figure 5-8).
3. Click **Add**.
4. Select **WORKLIST** from the Services drop-down list. The Modality Worklist server settings screen will appear (Figure 5-14).
5. Fill in Alias, AE Title, IP Address and Port number of the destination.
6. Click **Save** to store the settings.

Figure 5-14 Modality Worklist Server Settings

➤ To edit or delete a server

1. Press **SETUP**. The setup menu appears.
2. Select **DICOM**. The DICOM settings screen appears (Figure 5-8).
3. Highlight a server from the service list.
4. Click **Edit** to edit the server configuration, or click **Delete** to remove the selected server.

Installing a Network Printer

➤ To install a Codonics NP-1660 Network Printer

1. Set up the system for DICOM operation (“To configure the HDI 4000 system for DICOM operations” on page 100) setting the Codonics printer as the default printer.
2. Connect the printer as appropriate (Figure 5-15 through Figure 5-17).
3. Finish installing the Codonics NP-1660 printer as described in the *External Codonics NP-1660 Printer Field Installation Instructions* (P/N 8055-1767, -02 and up) or the *Codonics Printer Installation and Setup Video* (P/N WTE-9903), available through Philips Worldwide Sales Training and Education in Bothell.

Figure 5-15 **Codonics NP-1660 Printer LAN Connection Diagram**

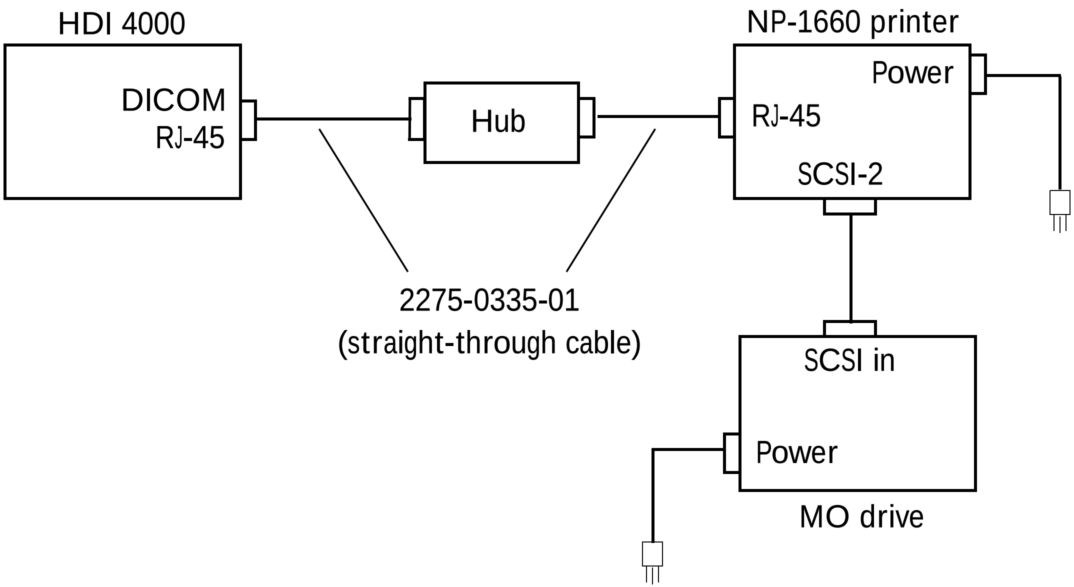


Figure 5-16 **Codonics NP-1660 Printer Ethernet Wall Jack Connection Diagram**

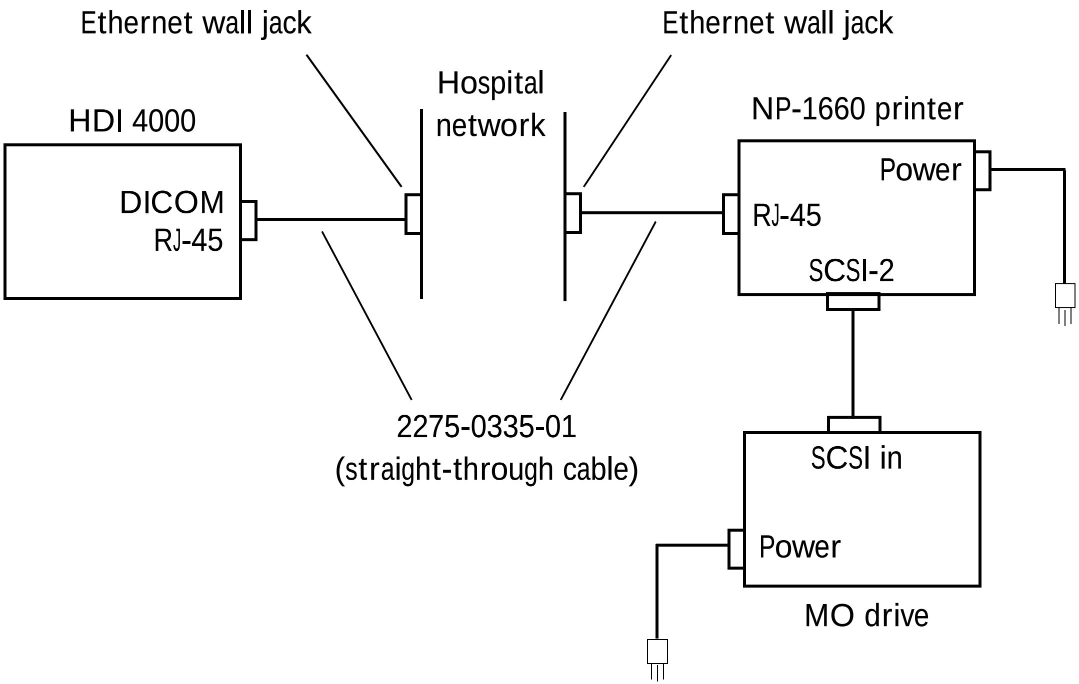
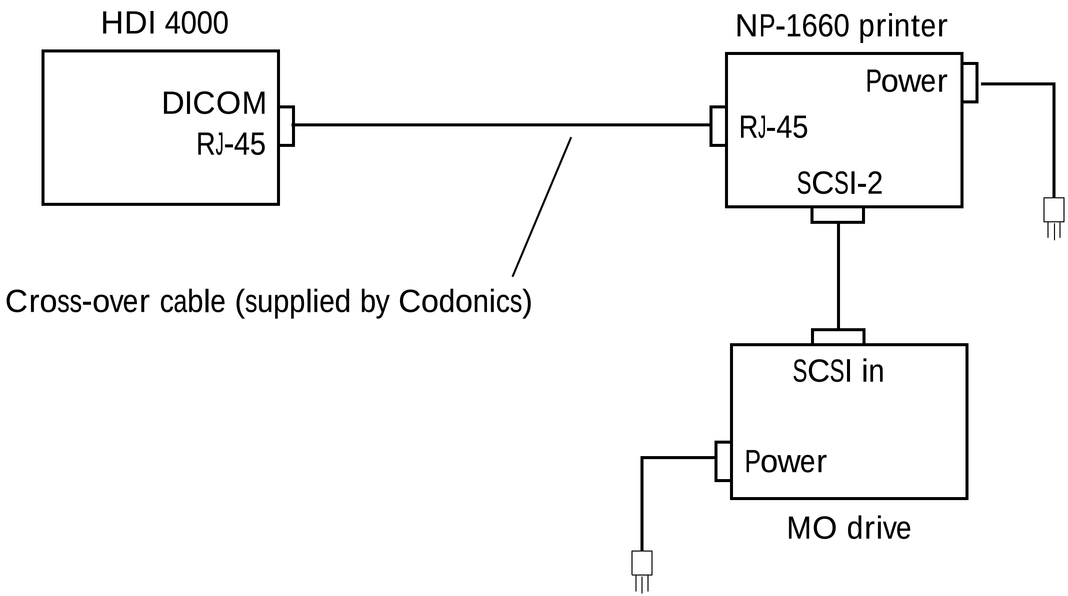


Figure 5-17 **Codonics NP-1660 Printer Point-to-Point Connection Diagram**



Language Settings

➤ **To verify that the operating system language setting and the control panel language setting match**

1. Access the operating system

NOTE The system will require rebooting

   a. Press and hold **Shift** and **Alt** and then **F4**.

   b. When the **Administrator Mode** password prompt appears, enter the appropriate password and press **Enter** (if you do not know the password, contact your local Philips technical support group).

   c. Press and hold **Shift** and then **F4**.The system display will switch to the operating system desktop screen with the HDI 4000 logo as the background image.

2. Use the trackball and **SET** to click **Start**.
3. Select **Settings** and then **Control Panel**.
4. Double-click **Keyboard**.
5. Click **Input Locales**.
6. Verify **Enable indicator on taskbar** is checked.
7. Verify/select the desired language from the **Input language** menu then select **Set as Default**. If the desired language is not shown in the **Input language** box, select the **Add** button and perform the following steps:

   a. Scroll down the selections in the **Add Input Locale** box and select the desired language.

   b. Click **OK**.

   c. Click **Set as Default**.

d. Click **Apply**, and then **OK**.

8. Close the **Control Panel** folder.
9. Click **Start** and select **Restart** or cycle power.

Presenting the System

Do not present the system until you have accomplished the actions described in “Setting Up the System” on page 96. When the system and the customer documents are ready, present them to the operators as follows:

1. Present an overview of the system to the operators, review the COA to familiarize them with the system and its options, and show them they have received what they ordered.
2. Present the system user manuals and operating notes, and introduce the online Help. Make the customer aware of the existence of online Help and that it provides them instructions for use of the system, on-screen, at the press of the **?** button. Describe our product documentation and show the operators all information needed to operate the system and peripherals. Review the information contained in each operating note with the operators, demonstrating the issue and the correct associated procedure. If questions arise, show the operators where to find the specific information in the documentation.
3. Show the operators how to turn on the system power.
4. Describe the initialization process and explain what is taking place during this time.
5. Explain the reasons for properly observing the warnings and cautions associated with this system.
6. Explain why it is important for the operators to never remove covers from the system, because of ESD and warranty considerations.
7. After the system is fully initialized, give the operators a brief demonstration of system controls.

8. Describe any peripherals provided with the system and demonstrate how to reload applicable consumables.
9. Describe and demonstrate system maintenance procedures to be performed as needed:
   - System cleaning
   - Scanhead disinfection
   - Any peripheral attention needed, as necessary
10. Review the procedures for requesting service or technical assistance.

6 Performance Tests

Introduction

This section contains performance tests based on the factory acceptance testing Philips Ultrasound performs when conducting the HDI 4000 functional audit. Use these tests to verify that a system is operating and performing correctly. Some or all of these tests should be performed as necessary, following installation, upgrade, preventive maintenance, or repair.

The procedures in this section are intended only for qualified technicians who have been trained by Philips to maintain HDI 4000 systems.

A list of tests is provided at the end of this section for use as a performance test checklist and a record of system performance (see “Performance Test Checklist” on page 136). Dated copies can serve as confirmation of proper system operation. If any of the tests fail, troubleshoot and repair the system and then restart and complete the performance testing.

Preparations

The tests in this section are organized to follow a logical progression through each of the major system operating functions. Philips recommends that you perform the tests in the sequence listed. The following paragraphs describe considerations and actions to take before performing the tests.

Warnings and Cautions

Review “Safety” on page 40 before continuing. Also heed all additional warnings and cautions contained in this section.

WARNINGS

- Use extreme caution if applying power to the system while protective covers are removed. Dangerous voltages are present. Only a qualified Philips customer service representative should work on internal system components.
- Do not wear ESD wrist straps grounded to the cart when working inside a system with its power turned on.

Initial Setup

Initial setup consists of applying system power and confirming a successful software initialization. You should also verify that the system configuration is consistent with the Customer Order Acknowledgement (COA).

These tests rely on the assumption that the site power is in compliance with the pre-installation criteria described in “Section 5, “Installation”.

Check the equipment for abnormalities or conditions that do not meet Philips standards.

Initialization and Monitor Tests

1. If not already done, plug the system power cord into a dedicated hospital grade outlet, rated for at least 15 Amperes.
2. Load printer paper and video cassette as required.
3. Connect two appropriate scanheads to the scanhead connectors.
4. Turn on the system power (Figure 6-1). Verify that all installed internal OEM peripheral “power on” indicators light.
5. After the system performs its initialization and self-test routine (about three minutes), confirm that a 2D startup display appears on the screen (Figure 6-2).

Figure 6-1 Power Switch Location

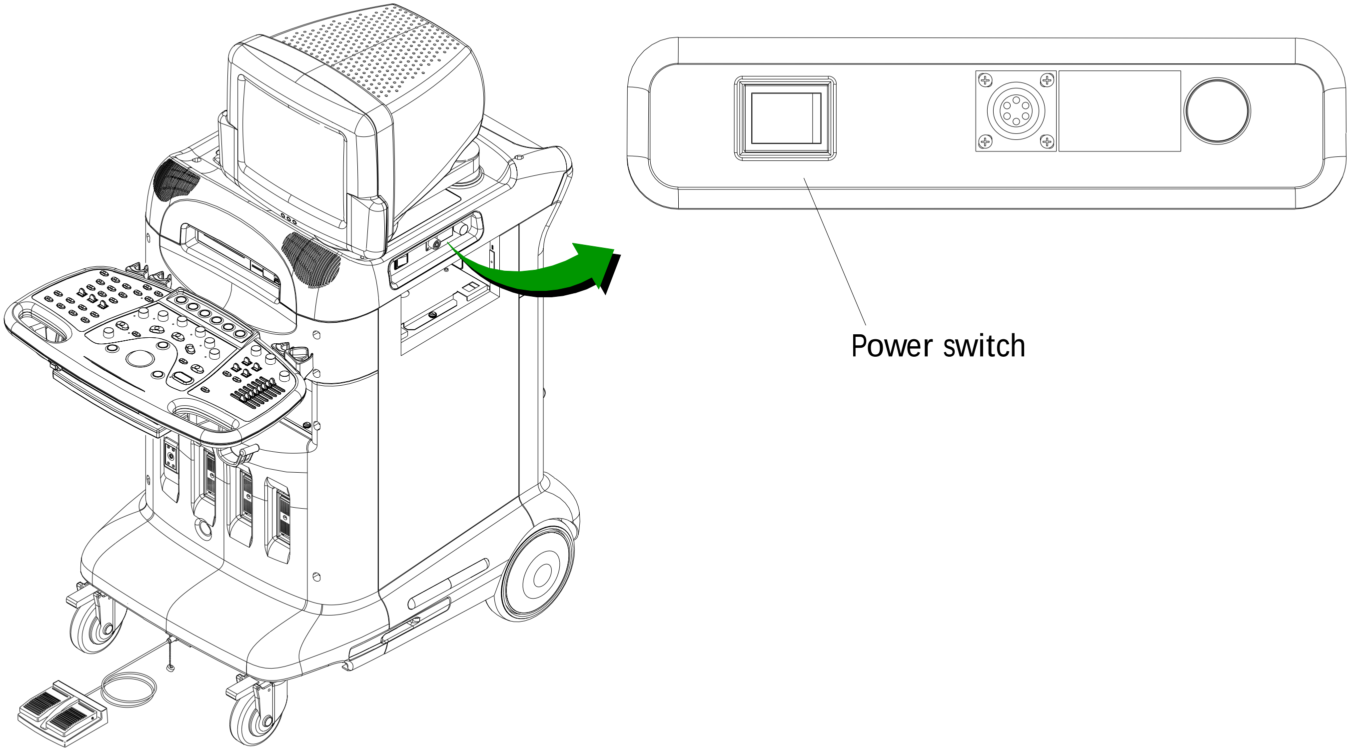
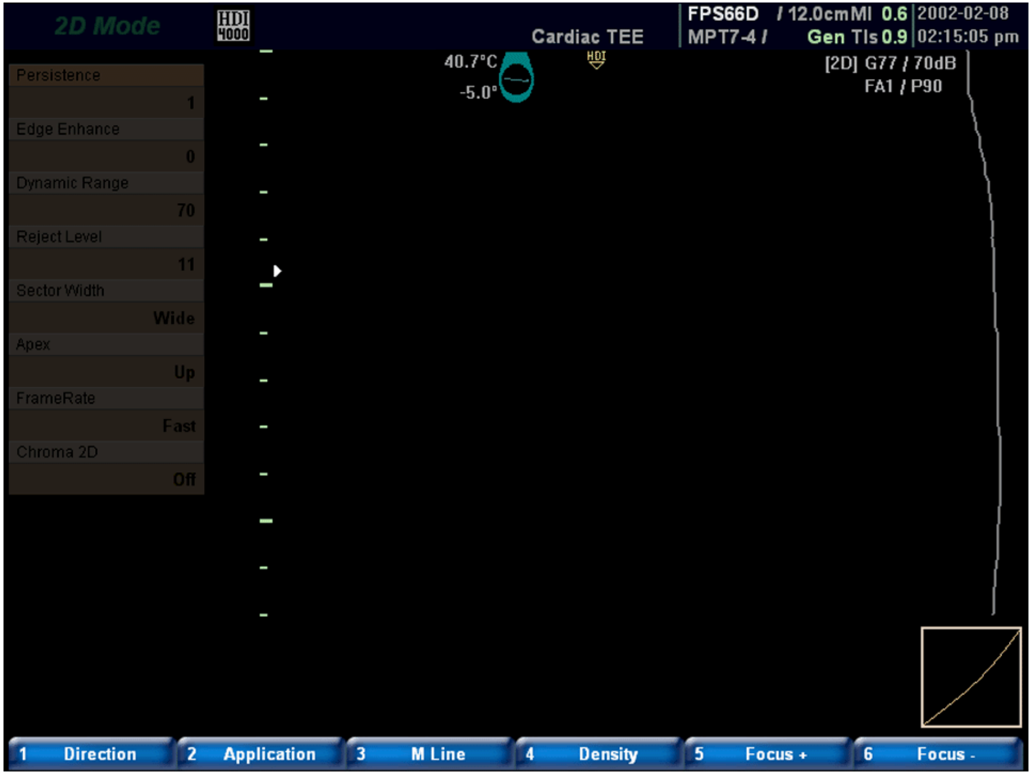


Figure 6-2 **System Startup display**



6. Verify that the system has the correct software level by reading the software version displayed on the screen during boot-up, or you can check it in system setups.
7. Select a scanhead and verify that the 2D image is updating.
8. On the monitor, confirm the following:
   a. Adjustment of the monitor brightness and contrast controls from the minimum to maximum results in no distortion (blooming) on the display.
   b. Display is centered on the screen, with good vertical and horizontal resolution (linearity).
   c. There is no tearing or bending at the corners.

NOTE If the monitor has any alignment or color problems, perform the monitor adjustments described in “Section 7, “Adjustments”.

Functional Tests

Use the following procedures to examine system functionality. If system testing reveals any problems, troubleshoot, repair, and retest the system.

Throughout performance testing, continue to verify the following general observations:

- The image is correctly placed on the video display.
- The indicators and backlighting associated with the controls on the control panel indicate correctly.
- Toggle switches, slides, trackball, and other moveable controls operate smoothly and efficiently.

If not already done, perform the actions described in “Initial Setup” on page 120.

General System Confidence Test

If the system diagnostics are enabled, run the **All Information** diagnostic to verify system information and to check that the primary PCBs pass their functional tests (see "Running the System On-Board Diagnostics" on page 155).

User Interface Tests

Operate each of the user interface controls to verify that the system user interface is performing correctly. Check the functions of the control panel, on-screen soft controls, and footswitch. A majority of this testing can be accomplished while performing the other tests in this section. Verify that the system responds correctly to each control and that the LEDs light for all controls that have LEDs. If necessary, look up the control function definition in the "Glossary" section of the *HDI 4000 System Reference Manual* (P/N 4703-0037-xx) or press **?** for the system online Help, and search for the control description you need. For v1.01.00.063 software, also see the *HDI 4000 Ultrasound System User Information Update* (P/N 4xx5-0037-02).

NOTE The blue buttons at the top center of the control panel numbered 1 through 6 are software-governed controls. They are used to activate the corresponding (1-6) multi-function, on-screen "soft controls" at the bottom of the display.

2D Image Test - Curved Array Scanheads

1. Turn the system power **OFF**, wait for a minimum of 10 seconds and then turn system power back **ON**.
2. Connect and select a curved array scanhead.
3. Verify that a 2D image is displayed and then image a 2D tissue phantom.
4. Set **POWER** to 100%.
5. Adjust the **2D** and **TGC** to produce a smooth, uniform 2D image with a minimum of noise. Do not reduce the gain to the point that the echoes in the far field are eliminated.
6. Adjust the position of the scanhead on the phantom to obtain an image that clearly shows both the horizontal and vertical rows of pins.

7. Verify that the image appears uniform in both the axial and lateral direction, without any dropouts or intensity variations.
8. Verify that the pins within the structure are clearly differentiated from the surrounding tissues.
9. Verify that the cystic structures at the focal zone are clearly differentiated from the surrounding tissues and are echo free, while the solid tissue, with numerous echo sources, appears solid.
10. Continue scanning the image phantom for 10 minutes using a combination of 2D, CPA, Color, and M modalities. Exercise the following soft controls across their full range of values while imaging and verify their proper operation:
    - 2D: **Direction, Application, M Line, Density, Focus +, Focus-, 2D, THI, DEPTH, FOCAL POS, TSI OPT., ZOOM, POWER, TGC, DUAL**
    - CPA: **Direction, M Line, Density, Maps, CPA, THI, DEPTH, FOCAL POS, ZOOM, POWER, TGC, DUAL**
    - Color: **Direction, M Line, Density, Maps, COLOR, THI, DEPTH, FOCAL POS, ZOOM, POWER, TGC, DUAL**
    - M-mode: **Direction, Application, Density, Display Format, M, THI, DEPTH, FOCAL POS, ZOOM, POWER, TGC**

NOTE Conduct the Doppler tests only if you have a Doppler phantom or a test subject.

11. Acquire a Doppler image for five minutes. During that time enter PW Doppler, PW Doppler + CPA, and PW Doppler + Color modalities. Exercise the following soft controls across their full range of values while imaging and verify their proper operation:

- PW Doppler: **PWD, ANGLE, Simultaneous, SV Size +, SV Size -,VOLUME, FILTER, SWEEP, BASELINE, SCALE, INVERT**
- PW Doppler + Color or CPA: **COLOR or CPA**

2D Image Test - Phased Array Scanheads

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select a phased array scanhead.
3. Verify that a 2D image is displayed and then image a 2D tissue phantom.
4. Set **POWER** to 100%.
5. Adjust the **2D** and **TGC** to produce a smooth, uniform 2D image with a minimum of noise. Do not reduce the gain to the point that the echoes in the far field are eliminated.
6. Adjust the position of the scanhead on the phantom to obtain an image that clearly shows both the horizontal and vertical rows of pins.
7. Verify that the image appears uniform in both the axial and lateral direction, without any dropouts or intensity variations.
8. Verify that the pins within the structure are clearly differentiated from the surrounding tissues.
9. Verify that the cystic structures at the focal zone are clearly differentiated from the surrounding tissues and are echo free, while the solid tissue, with numerous echo sources, appears solid.
10. Continue scanning the image phantom for 10 minutes using a combination of 2D, CPA, Color, and M modalities. Exercise the following soft controls across their full range of values while imaging and verify their proper operation:

- 2D: **Direction, Application, M Line, Density, Focus +, Focus-, 2D, THI, DEPTH, FOCAL POS, TSI OPT., ZOOM, POWER, TGC, DUAL**
- CPA: **Direction, M Line, Density, Maps, CPA, THI, DEPTH, FOCAL POS, ZOOM, POWER, TGC, DUAL**
- Color: **Direction, M Line, Density, Maps, COLOR, THI, DEPTH, FOCAL POS, ZOOM, POWER, TGC, DUAL**
- M-mode: **Direction, Application, Density, Display Format, M, THI, DEPTH, FOCAL POS, ZOOM, POWER, TGC**

NOTE Conduct the Doppler tests only if you have a Doppler phantom or a test subject.

11. Acquire a Doppler image for 10 minutes. During that time enter CW Doppler, CW Doppler + Color, PW Doppler, and PW Doppler + Color modalities. Exercise the following soft controls across their full range of values while imaging and verify their proper operation:
    - CW Doppler: **CW, DEPTH, ZOOM, THI.**
    - CW Doppler + Color Mode: **CW, DEPTH, ZOOM, THI, COLOR.**
    - PW Doppler: **PWD, ANGLE, Simultaneous, SV Size +, SV Size -, VOLUME, FILTER, BASELINE, SCALE, INVERT, High Q., Display Format**
    - PW Doppler + Color: **COLOR, UPDATE, Left Footswitch**

2D Image Test - Linear Array Scanheads

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select a linear array scanhead in General mode.
3. Verify that a 2D image is displayed and then image a 2D tissue phantom.
4. Set **POWER** to 100%.

5. Adjust the **2D** and **TGC** to produce a smooth, uniform 2D image with a minimum of noise. Do not reduce the gain to the point that the echoes in the far field are eliminated.
6. Adjust the position of the scanhead on the phantom to obtain an image that clearly shows both the horizontal and vertical rows of pins.
7. Verify that the image appears uniform in both the axial and lateral direction, without any dropouts or intensity variations.
8. Verify that the pins within the structure are clearly differentiated from the surrounding tissues.
9. Verify that the cystic structures at the focal zone are clearly differentiated from the surrounding tissues and are echo free, while the solid tissue, with numerous echo sources, appears solid.
10. Continue scanning the image phantom for 10 minutes using a combination of 2D, CPA, Color, and M modalities. Exercise the following soft controls across their full range of values while imaging and verify their proper operation:
    - 2D: **Direction, Application, M Line, Density, Focus +, Focus-, 2D, DEPTH, FOCAL POS, TSI OPT., ZOOM, POWER, TGC, DUAL**, **Trapezoid**
    - CPA: **Direction, M Line, Density, Maps, CPA, DEPTH, FOCAL POS, ZOOM, POWER, TGC, DUAL**
    - Color: **Direction, M Line, Density, Maps, COLOR, DEPTH, FOCAL POS, ZOOM, POWER, TGC, DUAL**
    - M-mode: **Direction, Application, Density, Display Format, M, DEPTH, FOCAL POS, ZOOM, POWER, TGC**

NOTE Conduct the Doppler tests only if you have a Doppler phantom or a test subject.

11. Acquire a Doppler image for five minutes. During that time enter PW Doppler, PW Doppler + CPA, and PW Doppler + Color modalities. Exercise the following soft controls across their full range of values while imaging and verify their proper operation:
    - PW Doppler: **PWD, ANGLE, High Q, SV Size +, SV Size -, FILTER, SWEEP, BASELINE, SCALE, INVERT**
    - PW Doppler + Color or CPA: **COLOR, STEER, Simultaneous, UPDATE, VOLUME**

Freehand 3D Test

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select any array scanhead.
3. Press **3D** and verify that the system enters 3D Scan mode.
4. Verify the **X**, **Y**, **Z**, **RECT.L**, **MAG**, **TH.L** labels are illuminated and that the **CW**, **PWD**, **CPA**, **COLOR**, **M**, and **2D** LEDs illuminate.
5. Scan a 2D tissue phantom and then press **FREEZE** and verify that a 3D image is acquired and displayed in the 3D VIEW screen.
6. Return to **2D** imaging.

Volume 3D Test

Perform this test only if the system has the 3D feature enabled.

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select a 3D5-3, 3D7-4, or 3D8-5v scanhead.
3. Press **3D** and verify that the system enters 3D Scan mode.
4. Press the **3D** soft control to select Static 3D mode.

5. Verify that the **X**, **Y**, **Z**, **RECT.L**, **MAG**, **TH.L** labels illuminate and that the **CW**, **PWD**, **CPA**, **COLOR**, **M**, and **2D** LEDs illuminate.
6. Scan a 2D tissue phantom and then press **FREEZE.** Verify that a 3D image is captured and displayed in the 3D VIEW screen.
7. Return to **2D** imaging.

Live 3D Test

Perform this test only if the system has the 3D feature enabled.

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select a 3D5-3, 3D7-4, or 3D8-5v scanhead.
3. Press **3D** and verify that the system enters 3D Scan mode.
4. Press the **Live 3D** soft control to enter Live 3D scan mode.
5. Scan a 2D tissue phantom and press **FREEZE.** Verify that a live 3D image is being captured and displayed in the 3D VIEW screen.
6. Return to **2D** imaging.

CW Static Probe Test

Conduct this test only if you have a Doppler phantom or a test subject.

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select a CW probe. Use the Default application.
3. Acquire a Doppler image. Adjust the scale and gain to produce a clear Doppler signal.
4. Verify that the Doppler annotation is displayed and the Doppler display is scrolling.

ECG Test

NOTE Conduct the ECG tests only if you have an ECG simulator.

1. Connect the ECG simulator to the system.
2. Set the simulator to 1mV amplitude, 60 BPM rate.
3. Connect and calibrate a phased array scanhead. Use the Cardiac application and Default setting.
4. Select ECG, set ECG to on, and verify that an ECG trace appears at the bottom of the screen.
5. Adjust the ECG gain up and down and verify that the ECG trace responds accordingly.
6. Set the ECG Trigger to on and verify that a red trigger cursor is displayed on the ECG trace.
7. Select Sync L and verify that the trigger cursor moves to the right as the trigger delay is increased.
8. Image a 2D tissue phantom and verify that the 2D image updates at every trigger.
9. Turn the ECG trigger off and verify that the 2D image updates normally.

Image Save Test

1. Turn the system power off, wait for a minimum of 10 seconds and then turn system power back on.
2. Connect and select any scanhead.
3. Insert a CD-R/W disk into the system CD-R/W drive.
4. Insert a formatted MO disk into the system MO disk drive.

NOTE The image storage tool supports only one CD-R/W session. Therefore, each time new images are stored onto a test CD-R/W disk, the images from the previous session will no longer be viewable.

5. Using **STORE**, save a number of images.
6. Press **END EXAM**.
7. Press **REVIEW** and do the following:
   a. Review the images.
   b. Backup the images onto the MO and delete them from the hard drive. Review the images on the MO and verify they were copied intact.
   c. Restore the images to the hard drive and delete them from the MO. Verify that they were deleted from the MO and are intact on the hard drive.
   d. Back up the images onto the CD-R/W disk and delete them from the hard drive. Review the images on the CD-R/W disk and verify they were copied intact.

NOTE Remember, this only works with a CD/RW disc, not a CD/R disk.

   e. Restore the images to the hard drive and delete them from the CD-R/W disk. Verify that they were deleted from the CD-R/W disk and are intact on the hard drive.
   f. Delete the test images from the hard drive.
   g. Click **Live Mode** to return to normal scanning.
8. Eject the MO and CD-R/W disks.

Peripheral Tests

B&W Printer Test

Conduct this test when a B&W image printer is installed.

1. If not already done, insert appropriate paper into the printer.
2. Acquire a 2D image and press **FREEZE**.

3. If only the B&W printer is installed, press **PRINT** on the system (otherwise press **PRINT** on the printer) and verify that the printer makes a print of the system video. Also verify that the print images are spatially correct horizontally and vertically and that they contain all the information being displayed on the system monitor.

VCR Test

Conduct this test when a VCR is installed.

1. If not already done, insert a tape into the VCR.
2. Record a few minutes of system imaging video on the VCR, include spectral and color Doppler.
3. Rewind the tape to the beginning of the recording.
4. Playback the recording and verify that the recorded imaging plays back and that the video is clear and stable.
5. Verify that the playback is similar in quality to the live system video. Some noise is expected from the VCR playback, but it should not be excessive or interfere with the quality of the image.
6. Verify that the Doppler audio playback is clear and properly oriented.
7. Return to normal imaging.

Color Printer Test

Conduct this test when a color image printer is installed.

1. If not already done, insert appropriate paper into the printer.
2. Acquire a 2D image using a 2D tissue phantom.
3. Select Color mode and increase the color gain to fill the color box with color.

4. Press **PRINT** on the system and then press **CAPTURE** and **PRINT** on the color printer.
5. Verify that the color is accurately reproduced on both of the color prints with respect to color intensity and hue (tint).
6. Verify that the graphics and graybar on the print are in sharp focus and that the graybar displays the full range of grayshades as seen on the monitor.
7. Verify that the print images are spatially correct, horizontally and vertically.

Network Printer Function Test

Conduct this test if a network printer is installed and you want to test the system DICOM printing function.

1. Use Review to print exams to a DICOM 3.0-compliant printer such as the Codonics NP-1660.
2. Verify that the system is set up for DICOM operation ("To configure the HDI 4000 system for DICOM operations" on page 100).
3. In the Review, press **OPEN** to enter the Exam List window.
4. Select the exams in the Exam List that you want to print.
5. Click **Print**. The DICOM Print dialog box appears.
6. Select the desired printer from the DICOM Printer dialog box.
7. Click **Print** to print the exams to the Selected DICOM printer. A progress dialog is displayed until the print is complete.

Report Printer Function Test

Conduct this test if a customer-provided report printer is installed and you want to test the system report printing function.

1. Enter the Setup menus and select the Epson 860 or 870 printer and 8x11 paper size
2. Press **CALC,** take a few measurements, and then press **Report**.
3. Verify that the printer prints the report and that all report information is present and legible then exit from the Report window.

Safety Tests

- Wall Outlet Wiring Test
- Power Distribution Outlet Test
- Ground Resistance Test
- Chassis Leakage Current Test
- ECG Leakage Test
- Scanhead Leakage Test
- Isolation Test

End of Testing

When the system passes the tests you conduct, delete your test patient files and make the system available for use. If any of the tests failed, troubleshoot and repair the system, and then restart and complete your performance testing.

Performance Test Checklist

7 Adjustments

Introduction

This section contains instructions for performing adjustments to a monitor in the field when preventive or corrective maintenance actions dictate. There are no other calibration or alignment adjustments to make in the field for this system. There are no voltage adjustments to make in the field for this system.

The procedures in this section should be performed only by qualified technicians who have been trained by Philips to maintain HDI 4000 systems.

Warnings and Cautions

Review “Safety” on page 40 before continuing. Also follow all additional warnings and cautions contained in this section.

WARNING

Do not wear ESD wrist straps grounded to the cart when working inside a system with its power turned on.

Totoku Monitor Adjustments

NOTE Once activated, if after a few seconds the on-screen display senses no activity, it will time out.

➤ To check or adjust the monitor contrast and brightness settings

1. Display the system startup or any dark-background screen.
2. At the bottom front of the monitor, press **Menu** once. When the CONTRAST on-screen display appears (Figure 7-1), verify that the value is set at 65%. If it is not, use the **-** or **+** control to change the value to 65.
3. Press **MENU** again. When the BRIGHTNESS on-screen display appears (Figure 7-2), verify that the value is set at 73%. If it is not, use the **-** or **+** control to change the value to 73.
4. Press **MENU** again to close the on-screen display and to save the values indicated.

➤ To check or adjust the advanced monitor settings

1. Display the system startup or any dark-background screen.
2. At the bottom front of the monitor, press and hold **Menu** for about 10 seconds until the MAIN MENU (Figure 7-3) is displayed.
3. Use the **MENU**, **-** and **+** controls to select the items to be adjusted, verify or change the settings, and save the changes.
4. Set the overall image size to 270mm X 202mm.
5. Set the Red, Green, Blue levels to 83%.

Figure 7-1 **CONTRAST On-Screen Display**

Figure 7-2 **BRIGHTNESS On-Screen Display**

Figure 7-3 MAIN MENU On-Screen Display

MAIN MENU
EXIT
COLOR
SIZE/CENTER
GEOMETRY
UTILITY
ENTER:MENU SELECT: +/-

8 Preventive Maintenance

Introduction

This section identifies activities supporting the quality assurance audit (QAA) concept that you should perform in accordance with Customer Field Service policy. QAA activities include, but are not necessarily limited to, the following types of concerns:

- System Performance Issues
  - specific system service history
  - product history (see "Change History" on page 222)
- Electrical and Mechanical Integrity (see "Inspection" on page 141
- System Performance Testing (see "Performance Tests" on page 119 and "Adjustments" on page 137)
- Exterior and Interior Cleaning (see "General System Cleaning" on page 142

Equipment and Supplies

The tools, parts, and supplies needed for the preventive maintenance activities are identified as part of the described or referenced procedures.

Inspection

Ensure that all system hardware is in the correct place and properly secured. Check the equipment for abnormalities or conditions that do not meet the manufacturer's specifications. Inspect all wheel locks, cables, power cords, scanheads, scanhead connectors, fans, shields, ground straps, PCBs, and fasteners to ensure they are in good working condition. Verify that the equipment is up to date.

General System Cleaning

Clean or replace the system air filter (Figure 14-30) as its condition warrants.

Use a vacuum cleaner, compressed air, or soft-bristle brush to remove any lint and dust from the air-flow passages and components associated with the fan assemblies, PCBs, and any other system components that may have accumulated dust or dirt. Use mild, nonabrasive, standard computer-cleaning products to clean the monitor, keyboard, and system surfaces.

CAUTION

When cleaning the system keyboard and monitor, take care not to get any solution inside the housings. Also, take care not to scratch the face of the monitor while cleaning it.

OEM Peripherals

In accordance with Customer Field Service policy, perform any preventive maintenance recommended and described in the OEM manual for each installed peripheral:

- Panasonic AG-MD835 Video Cassette Recorder – 4740-0292-01(E); 4740-0291-01 (P)
- Sony UP-895MD Black and White Video Page Printer – 4740-0299-01
- Mitsubishi CP800 Color Video Page Printer – 4740-0296-01
- Sony UP-21MD Color Video Page Printer – 4740-0301-01(Vol 1); 4740-0302-01 (Vol 2)

CAUTION

To avoid damaging the Sony UP-21 printer, if the need arises, be sure to secure the thermal printing head before shipping as described in “To secure the Sony UP-21 print head for transport:” on page 182.

Alignment, Calibration

Perform the monitor adjustments in “Adjustments” on page 137 and the tests in “Performance Tests” on page 119 on a schedule that is in accordance with Customer Field Service policy to ensure that the system and peripherals are working properly.

Other Maintenance

For scanhead cleaning and disinfection procedures, refer to *Using Disinfectants and Gels*, part number 4700-0249-XX.

Perform other cleaning and inspection procedures as specified by Customer Field Service policy.

9 Troubleshooting

Introduction

The troubleshooting information provided in this section will assist you in determining if a system is failing, and if so, will help you isolate the cause.

Start Here

1. Prior to taking any action, it is important that you review all relevant warnings, cautions, and procedures.
2. If possible, make a hardcopy print of the system display that shows the first indication of the failure. Take hardcopy prints of any system displays that reveal the failure as soon as possible to ensure this type of data is not lost. Relevant data is often lost when the system is re-booted.
3. Try to determine if the symptoms indicate an operating/procedural error or a system failure, and if a system failure, whether it is an operating system or an ultrasound problem.
4. Consider the situation: When was the last time the system was working correctly and what, if any, influencing circumstances have occurred since? Check the system configuration.
5. Check for obvious causes and solutions: Voltage at electrical outlets, “tripped” circuit breakers, blown fuses, disconnected or damaged wires, etc.
6. If the system diagnostics are enabled, run them to see if the tests detect and report any failures (see “Running the System On-Board Diagnostics” on page 155).
7. Conduct tests from “Performance Tests” on page 119 as required to determine if the system is failing or to attempt to replicate the failure.
8. Consider the value against the difficulties of swapping suspect components with good ones. Do *not* cause additional problems or confuse your search. *Never* swap parts if a known good item might be damaged.

9. Once the fault has been identified, perform the authorized corrective action needed to repair the failure, and conduct the tests necessary to ensure the system meets an optimum level of performance.

Warnings and Cautions

Review “Safety” on page 40 before continuing. Also follow all additional warnings and cautions contained in this section.

WARNINGS

- Dangerous voltages are present when protective covers are removed. Use extreme caution.
- Do not wear ESD wrist straps grounded to the cart when working inside a system with its power turned on.
- Do not replace components with power connected. Under certain conditions, dangerous voltages may exist with power disconnected. Always disconnect power and allow circuits to discharge before touching any components.
- To protect against fire hazard, only use replacement fuses of the same type and rating as the original fuses.

CAUTIONS

- Always turn power off and wait at least 30 seconds before removing or installing any PCB, module, or component.
- Always use correct ESD procedures. Do not handle PCBs without proper ESD protection. Damage to components will result from improper handling.

Failure Symptoms and Solutions

Table 9-1 lists some general trouble symptoms and recommended actions.

Table 9-1 Symptoms and Recommended Action

Symptom or Condition	Recommended Action
System will not power on (no audible fan or relay noise when the POWER switch is on).	Verify that the AC source is active, at the correct voltage, and the system power cord is connected. Check that the main power switch is on. Check that the main power fuses are good, as described in "Checking Fuses" on page 153. Verify the power supply voltages as described in "Checking the Power Supply Voltages" on page 169.
System will not power on (fans run, but no audible relay noises are heard when the POWER switch is on).	Verify the DC power supply voltages as described in "Checking the Power Supply Voltages" on page 169.
System displays "boot error" message	See Table 9-2.
System power is on, but no display shows on monitor.	After power up, HDI 4000 takes approximately one minute to initialize the software and hardware. Check that the AC and video cables to the monitor are connected. Check contrast and brightness adjustments on monitor.

Table 9-1 Symptoms and Recommended Action (Continued)

Symptom or Condition	Recommended Action
System power is on, but no display shows on monitor (cont.)	Consider if the lithium CMOS battery on the Industrial PC Card has failed (although the battery is usually reliable, with a life expectancy of five to seven years), preventing computer bootup. **Note:** If a hardcopy print can be made that shows a display, the system is probably OK, and the monitor is probably bad.
System monitor has a “shuddering” display or noise in the image.	Consider the possibility of EMI or RFI as described in “Checking for EMI and RFI” on page 174. Check print quality for similar noise. If it is on the print, it is probably an internal system failure. Troubleshoot the PCBs.
System power is on, but OEMs will not power on or will not function.	Verify that the correct AC voltage is present at the OEM receptacle. If AC voltage is not present at the OEM receptacle, check it at the power supply (“Checking the Power Supply Voltages” on page 169). Verify that the OEMs are connected, and that the settings are configured, as referenced in “Cabling” on page 190.
Cannot select a scanhead, and the message “Please connect any scanhead” is displayed.	Verify that all scanhead circuit connections are properly seated.
Cannot Export images to the MO Disk.	Verify that the MO Disk is formatted.

Table 9-2 System Boot Errors and Likely Cause

System Boot Failure Error Message	Error Code#	Most Likely Cause
Error Code# FILE_NOT_FOUND	0	Software (HDD failure or not seated and locked)
Error Code# NO_MOTOR_CONTROL_FOUND	1	Motor board
Error Code# PCI9054_OPENDMA_FAIL_IN_HWINIT	2	PC board
Error Code# PCI9054_OPENDMA_FAIL_IN_CINESAVE_BW	3	PC board
Error Code# PCI9054_OPENDMA_FAIL_IN_CINESAVE_COLOR	4	PC board
Error Code# PCI9054_OPENDMA_FAIL_IN_GET_3DDATA	5	PC board
Error Code# PCI9054_OPENDMA_FAIL_IN_GET_ANGIO_3DDATA	6	PC board
Error Code# PCI9054_OPENDMA_FAIL_IN_GET_COLOR_3DDATA	7	PC board
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_CINESAVE_BW	8	DSC
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_CINESAVE_COLOR	9	DSC
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_VM_DMA	10	DSC
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_FREEHAND3D	11	DSC
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_GET_3DDATA	12	DSC
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_GET_ANGIO_3DDATA	13	DSC

Table 9-2 System Boot Errors and Likely Cause (Continued)

System Boot Failure Error Message	Error Code#	Most Likely Cause
Error Code# CINE_FIFO_EMPTY_FLAG_CHECK_FAIL_IN_GET_COLOR_3DDATA	14	DSC
Error Code# VM_READ_ERROR_BW_IMAGE	15	VM
Error Code# VM_READ_ERROR_IN_COLOR_IMAGE	16	VM
Error Code# VM_READY_ERROR_IN_DRAW_POSTBAR_GRAY	17	VM
Error Code# VM_READY_ERROR_IN_DRAW_POSTBAR_COLOR	18	VM
Error Code# HW_ECHO_CHECK_FAIL	19	CW or BF
Error Code# DSC_READY_ERROR_IN_COMMAND_SEND	20	DSC
Error Code# VM_READY_ERROR_IN_COMMAND_SEND	21	VM
Error Code# CLT_READY_ERROR_IN_COMMAND_SEND	22	DSP
Error Code# AUD_READY_ERROR_IN_COMMAND_SEND	23	DSP
Error Code# FFT_READY_ERROR_IN_COMMAND_SEND	24	DSP
Error Code# PDSP0_READY_ERROR_IN_COMMAND_SEND	25	DSP
Error Code# PDSP1_READY_ERROR_IN_COMMAND_SEND	26	DSP
Error Code# PDSP2_READY_ERROR_IN_COMMAND_SEND	27	DSP
Error Code# PDSP3_READY_ERROR_IN_COMMAND_SEND	28	DSP
Error Code# RTC_PM_CHECK_FAIL	29	CW or DSC
Error Code# DSC_PM_CHECK_FAIL	30	DSC
Error Code# VM_PM_CHECK_FAIL	31	VM
Error Code# CLT_PM_CHECK_FAIL	32	DSP

Table 9-2 System Boot Errors and Likely Cause (Continued)

System Boot Failure Error Message	Error Code#	Most Likely Cause
Error Code# FFT_PM_CHECK_FAIL	33	DSP
Error Code# AUD_PM_CHECK_FAIL	34	DSP
Error Code# PDSP0_PM_CHECK_FAIL	35	DSP
Error Code# PDSP1_PM_CHECK_FAIL	36	DSP
Error Code# PDSP2_PM_CHECK_FAIL	37	DSP
Error Code# PDSP3_PM_CHECK_FAIL	38	DSP
Error Code# FPGA_DOWNLOAD_ERROR_RTC	39	DSC
Error Code# FPGA_DOWNLOAD_ERROR_MEMORY	40	DSC
Error Code# FPGA_DOWNLOAD_ERROR_INCTR	41	DSC
Error Code# FPGA_DOWNLOAD_ERROR_INCTR_DG	42	DSC
Error Code# FPGA_DOWNLOAD_ERROR_BW_RADIAL	43	DSC
Error Code# FPGA_DOWNLOAD_ERROR_CD_RADIAL	44	DSC
Error Code# FPGA_DOWNLOAD_ERROR_CD_PIXEL	45	DSC
Error Code# FPGA_DOWNLOAD_ERROR_FRAME_INTP	46	DSC
Error Code# FPGA_DOWNLOAD_ERROR_BW_FRAME_INTP	47	DSC
Error Code# FPGA_DOWNLOAD_ERROR_MID_PRE	48	DSP
Error Code# FPGA_DOWNLOAD_ERROR_MID_POST	49	DSP
Error Code# FPGA_DOWNLOAD_ERROR_AXIAL	50	DSC
Error Code# FPGA_DOWNLOAD_ERROR_LOOP	51	DSC
Error Code# FPGA_DOWNLOAD_ERROR_IMG	52	DSC

Table 9-2 System Boot Errors and Likely Cause (Continued)

System Boot Failure Error Message	Error Code#	Most Likely Cause
Error Code# FPGA_DOWNLOAD_ERROR_DMA	53	DSC
Error Code# FPGA_DOWNLOAD_ERROR_POST	54	VM
Error Code# FPGA_DOWNLOAD_ERROR_ZOOM	55	VM
Error Code# FPGA_DOWNLOAD_ERROR_NI2I	56	VM
Error Code# FPGA_DOWNLOAD_ERROR_DVD	57	VM
Error Code# HV_DATA_DOWNLOAD_ERROR	58	CW
Error Code# DSC_FM_ALL_WRITE_FAIL	59	DSC
Error Code# DSC_Generation_Fail	60	DSC
Error Code# DSC_LoopMem_Clear_Fail	61	DSC
Error Code# DSC_CLEAR_MEMORY_FAIL	62	DSC
Error Code# DSC_INPUT_SSRAM_CLEAR_FAIL	63	DSC
Error Code# RTC_DSP_ACK_ERROR	64	DSC
Error Code# DSC_DSP_ACK_ERROR	65	DSC
Error Code# VM_DSP_ACK_ERROR	66	VM
Error Code# CLT_DSP_ACK_ERROR	67	DSP
Error Code# AUD_DSP_ACK_ERROR	68	DSP
Error Code# FFT_DSP_ACK_ERROR	69	DSP
Error Code# PDSP0_DSP_ACK_ERROR	70	DSP
Error Code# PDSP1_DSP_ACK_ERROR	71	DSP
Error Code# PDSP2_DSP_ACK_ERROR	72	DSP

Table 9-2 System Boot Errors and Likely Cause (Continued)

System Boot Failure Error Message	Error Code#	Most Likely Cause
Error Code# PDSP3_DSP_ACK_ERROR	73	DSP
Error Code# DSC_DSP_ACK_ERROR0	74	DSC
Error Code# DSC_DSP_ACK_ERROR1	75	DSC
Error Code# DSC_DSP_ACK_ERROR2	76	DSC
Error Code# DSC_DSP_ACK_ERROR3	77	DSC
Error Code# DSC_DSP_ACK_ERROR4	78	DSC
Error Code# DSC_DSP_ACK_ERROR5	79	DSC
Error Code# DSC_DSP_ACK_ERROR6	80	DSC
Error Code# DSC_DSP_ACK_ERROR7	81	DSC
Error Code# RTC_STOP_ERROR	82	DSC
Error Code# VM_FREEZE_ERROR	83	VM
Error Code# VM_DMA_FIFO_READ_ERROR	84	VM
Error Code# MOTOR_NULL_POSITION_LOST	85	Motor board
Error Code# MOTOR_CONTROL_SEQUENCE_BROKEN	86	Motor board or CW
	**	
** Any error code higher than 86 = BF board failure		

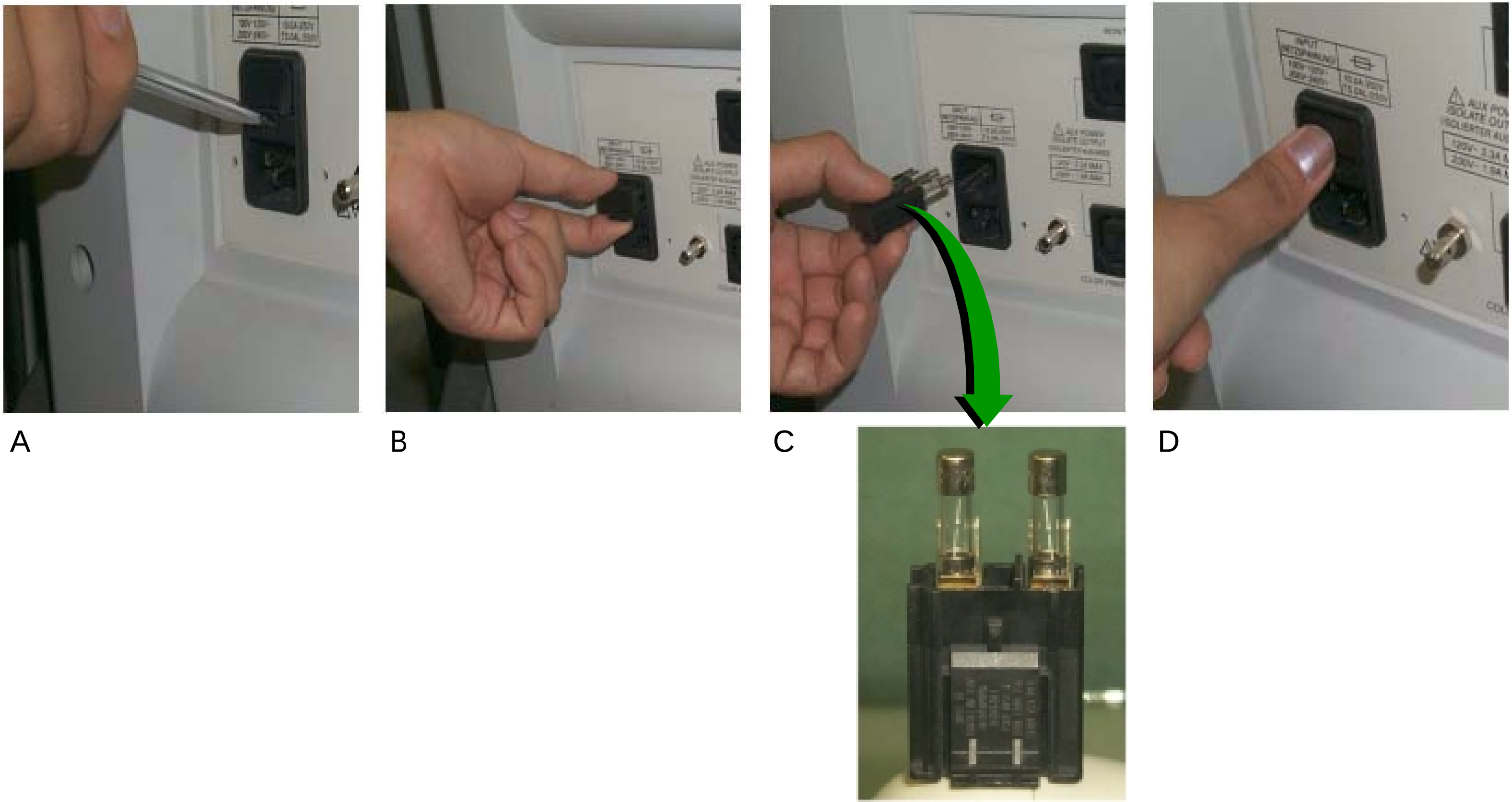
Checking Fuses

1. Turn the system power off and unplug the power cord.
2. Using a screwdriver, push up the tab of the fuse drawer on the upper side of the appliance inlet, and pull out the fuse holder as shown in Figure 9-1.
3. Remove the old fuse by pulling up.
4. Install the new fuse by pushing it into the fuse holder.
5. Insert the fuse holder in the appliance inlet. The direction arrow on the upper side of the fuse holder should match that on the fuse drawer.
6. Push in the fuse drawer until it snaps shut.

Table 9-3 Fuse Requirements

System AC Source Voltage	Fuse Required
100-120VAC	10.0A /250V
200-240VAC	T5.0AL/250V

Figure 9-1 **Protect Circuit Location & Replacement**



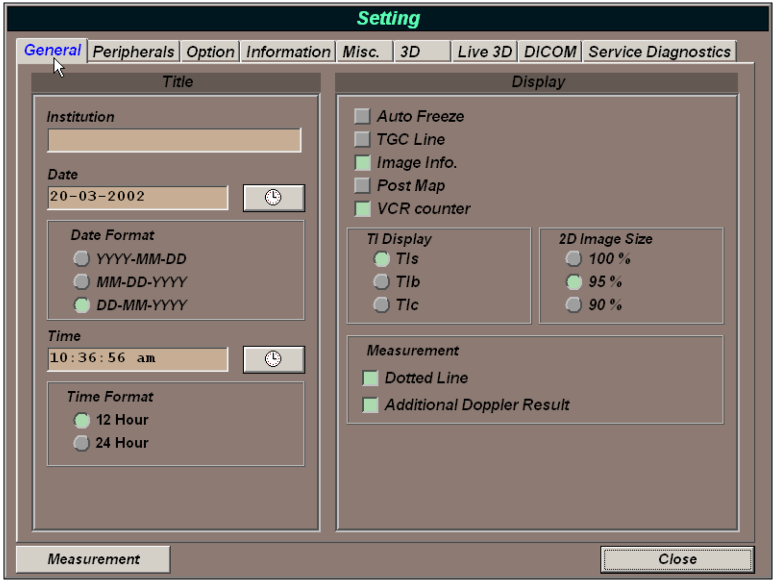
Running the System On-Board Diagnostics

1. Connect any scanhead except the L12-5 (which still always produces erroneous beamformer test failures at this release).
2. If the system is functional enough to do so and diagnostics are enabled, press **SETUP** to access the diagnostics. The Setting screen will appear (Figure 9-2).

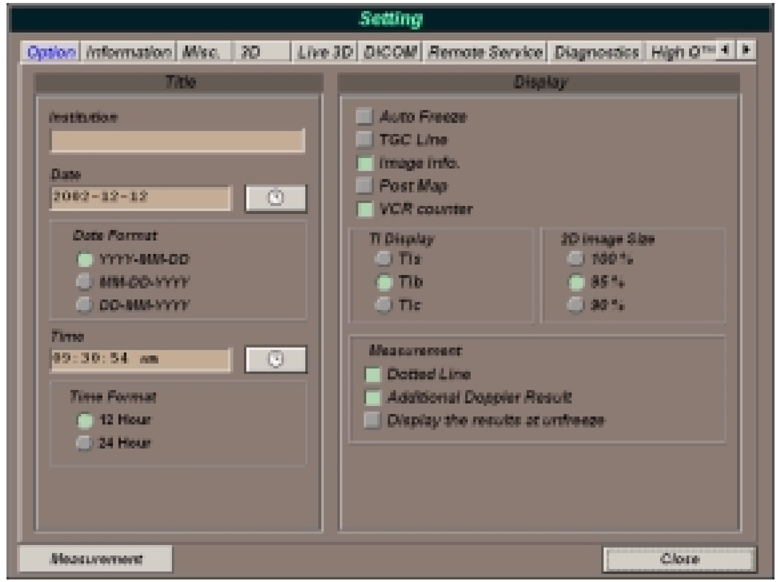
NOTE Review the service diagnostics history on page 227 before continuing. If you are trained and have the Remote Service Client software installed (release to be determined), you can choose to run the Remote Service diagnostics (Figure 9-3) with expanded features from a PC (refer to *HDI 4000 Remote Service Diagnostics User Manual* 4730-0049-xx, when released).

3. If you are on a system with 1.01.00.059 or higher software, click **Diagnostics** and then **Diagnostics**. You will not encounter a password shield for on-board diagnostics, but the same Confirm dialog box does appear as on earlier software (Figure 9-4). Skip to step 6.
4. If you are on a system with 1.00.05.053 or previous software, click **Service Diagnostics** and then **Diagnostics**, the Authorization code input dialog box will appear (Figure 9-5).
5. Enter the authorization code (password) and then click **OK** (if you do not know the password, contact your local Philips technical support group). The Confirm dialog box appears (Figure 9-4).
6. To proceed with the diagnostic tests, click **Yes**. The message "Preparing Diagnostics Please Wait" will appear, shortly followed by the DIAGNOSTICS menu (Figure 9-6).

Figure 9-2 System Diagnostics Access Point

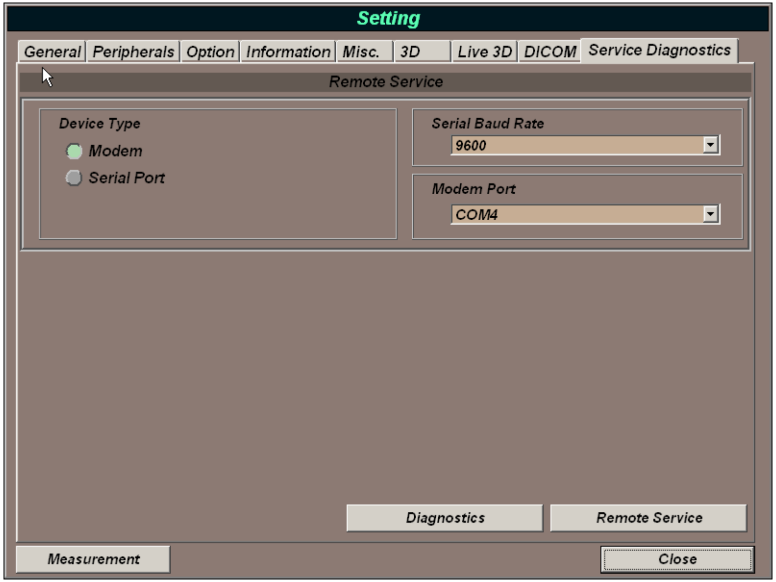


v1.00.05.053 (and previous) software

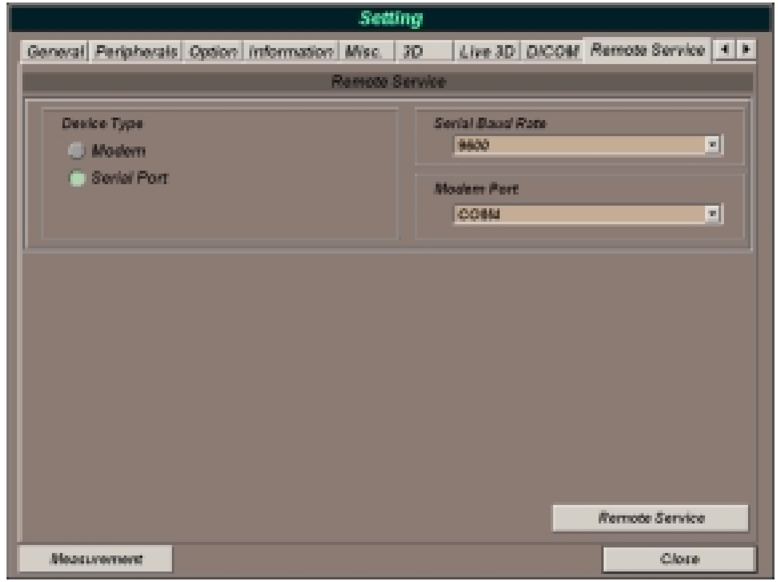


v1.00.01.059 (and higher) software

Figure 9-3 On-System or Remote Diagnostics Selection Point



v1.00.05.053 (and previous) software



v1.00.01.059 (and higher) software

Figure 9-4 System Diagnostics Run-Confirm Dialog Box

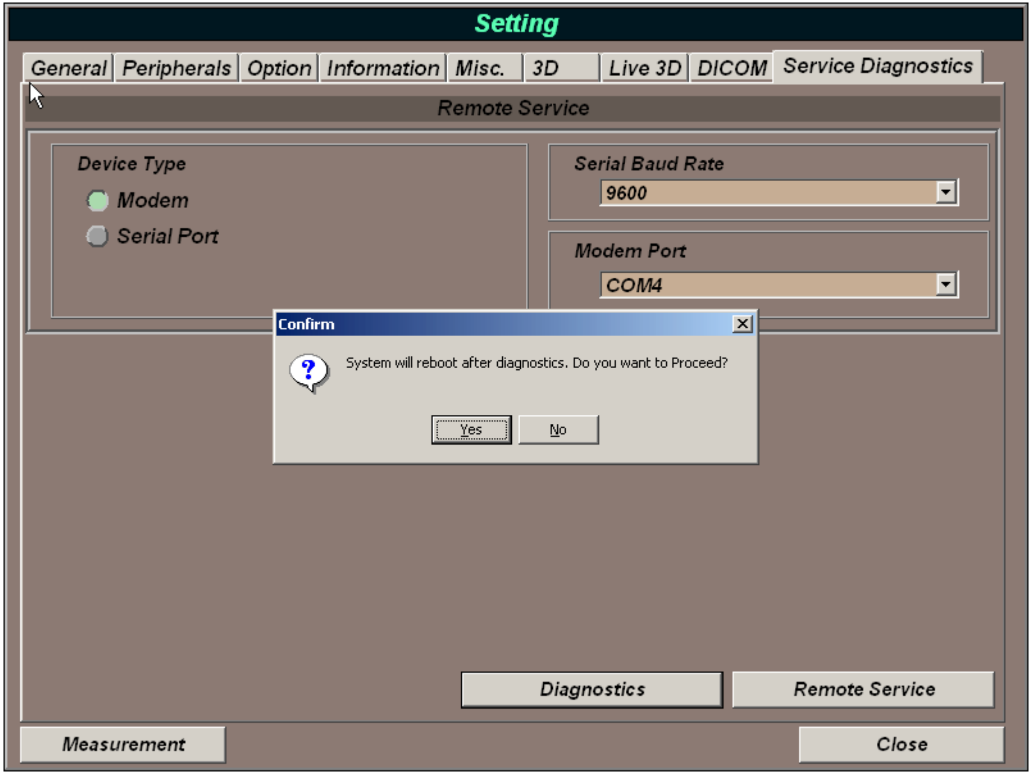
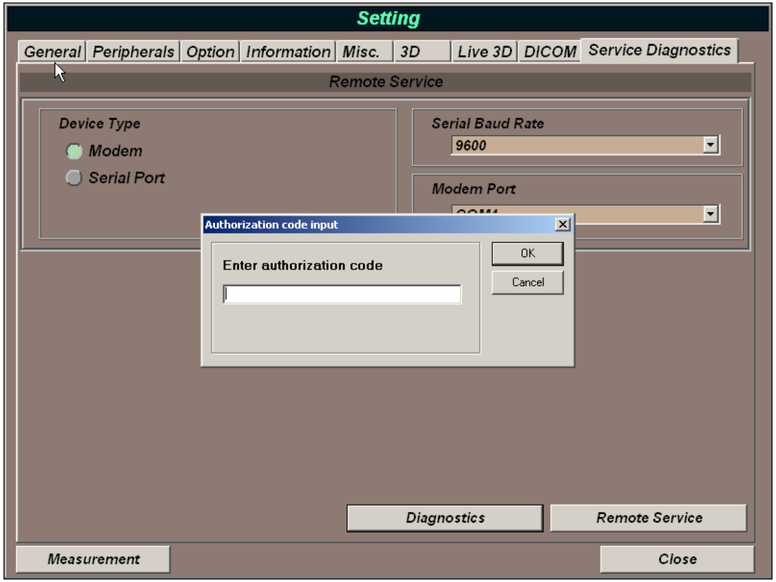
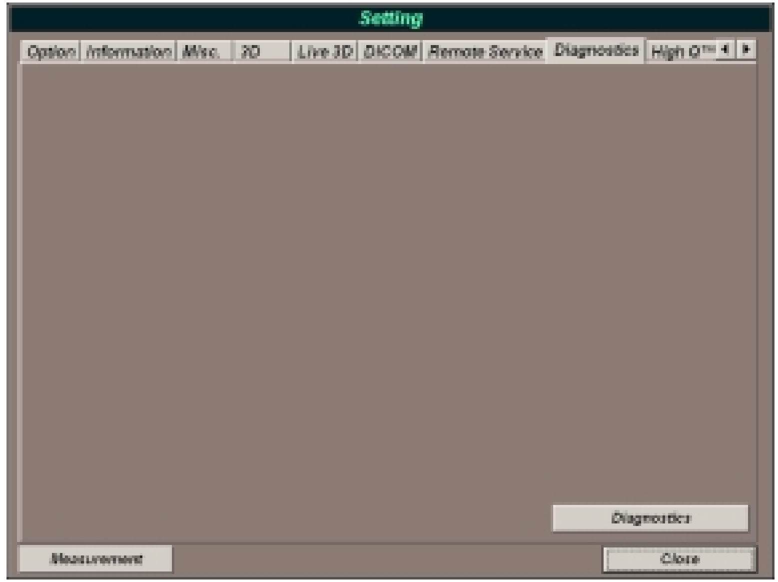


Figure 9-5 **System Diagnostics Access-Authorization Dialog Box**

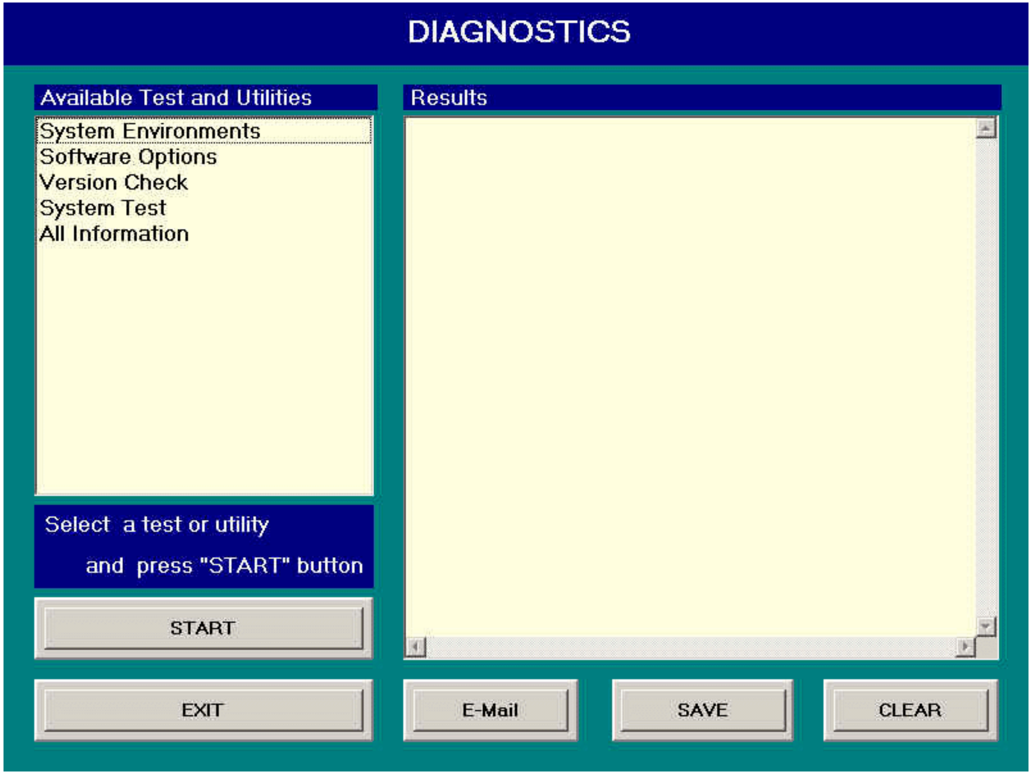


v1.00.05.053 (and previous) software



v1.00.01.059 (and higher) software

Figure 9-6 Diagnostics Menu



7. Highlight the test or utility that you want to run and click **START**. The results of all of the diagnostics you run will accumulate separately in the Results portion of the screen, even if you repeat them. Samples of the test results are shown in Figure 9-7 through Figure 9-11 and are summarized here:
   - **System Environments** (Figure 9-7) – Lists information about the computer platform. Run time is a few seconds.
   - **Software Options** (Figure 9-8) – Indentifies what system options are installed. Run time is a few seconds.
   - **Version Check** (Figure 9-9) – Summarizes the software module versions and installed hardware versions. Run time is a few seconds.
   - **System Test** (Figure 9-10 and Figure 9-11) – Performs various checks on each of the main system PCBs (BF, DSP, DSC, VM) and the data path between them. Run time is about seven minutes.

NOTE When a BF channel test produces a “Fail” result, initially you won’t know if the problem is a BF PCB or a scanhead. In this circumstance, replace the scanhead first and then run the diagnostic again. Remember, the L12-5 still always produces beamformer test failures at this release.

   - **All Information** – Runs all of the available diagnostic selections sequentially. All of the results will accumulate in the Results portion of the screen, which you can scroll. Run time is about seven minutes.

8. Press **SAVE** (Figure 9-12) to save the displayed results in a file. Select either the system hard disk or MO disk if you are running the diagnostics from the system, or your laptop if you are running them via the serial port. You must also specify a file name.
9. Press **CLEAR** if you want to erase all of the results in the Results portion of the screen. If you run another test or utility during the session, the information in the Results area will be added to the previous results.
10. Press **EXIT** to close the diagnostics session and reboot the system.

NOTE **E-mail** is not functional at this time.

Figure 9-7 System Environments Results

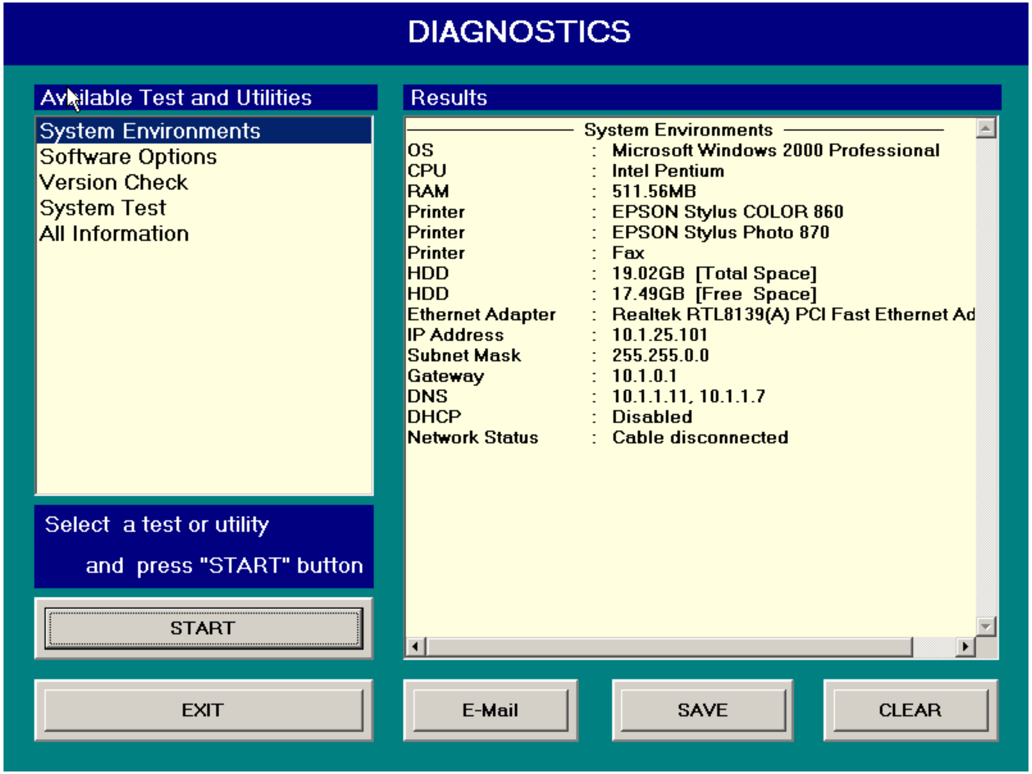


Figure 9-8 Software Options Results

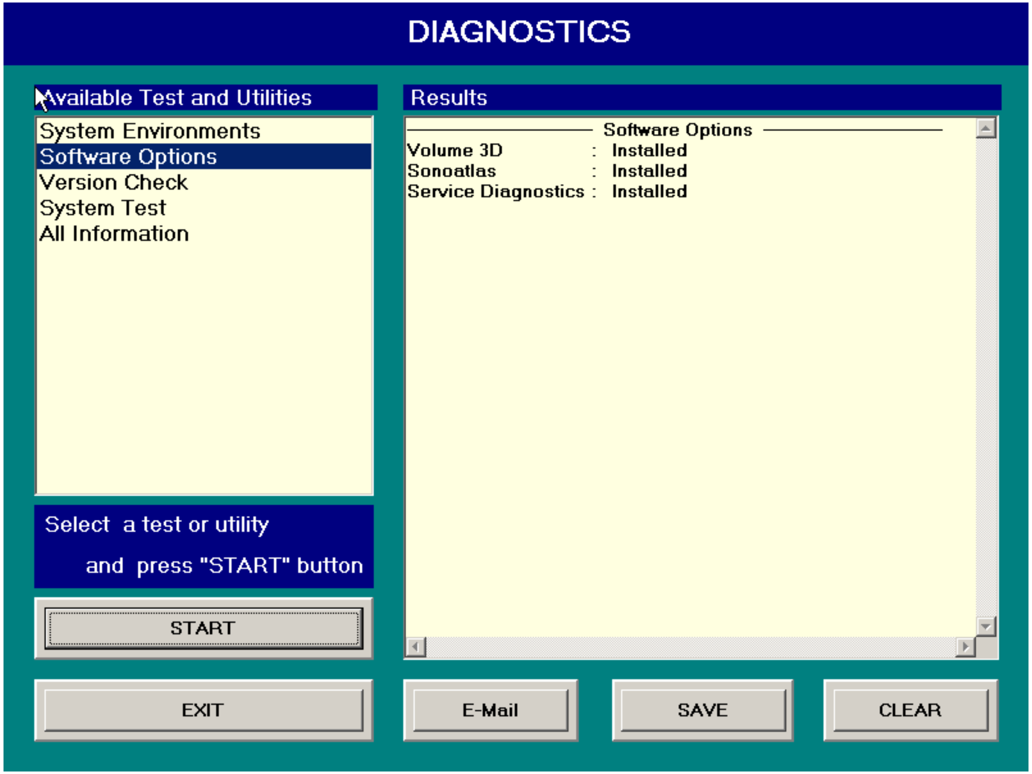


Figure 9-9 Version Check Results

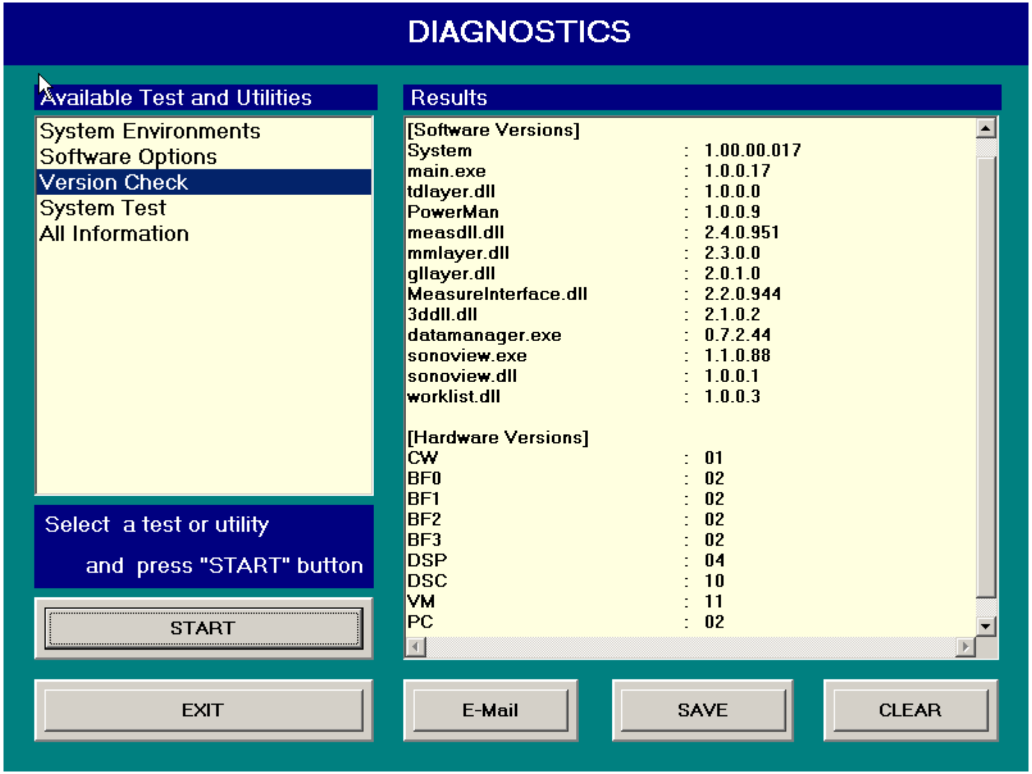


Figure 9-10 **System Test Results (1 of 2)**

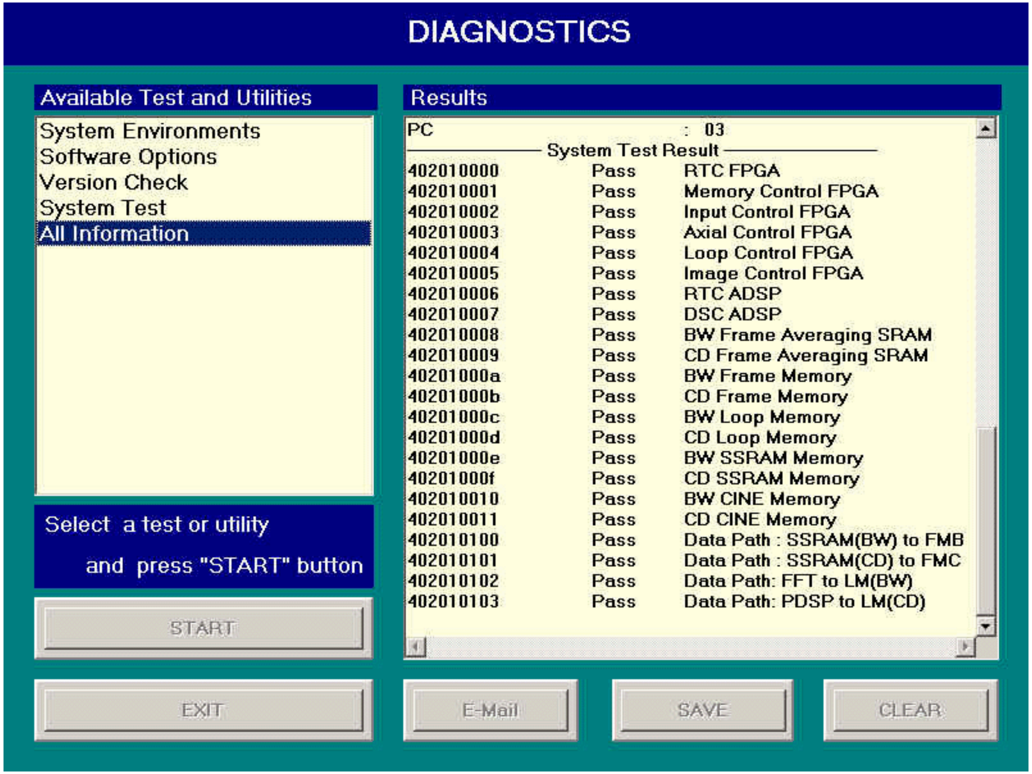


Figure 9-11 System Test Results (2 of 2)

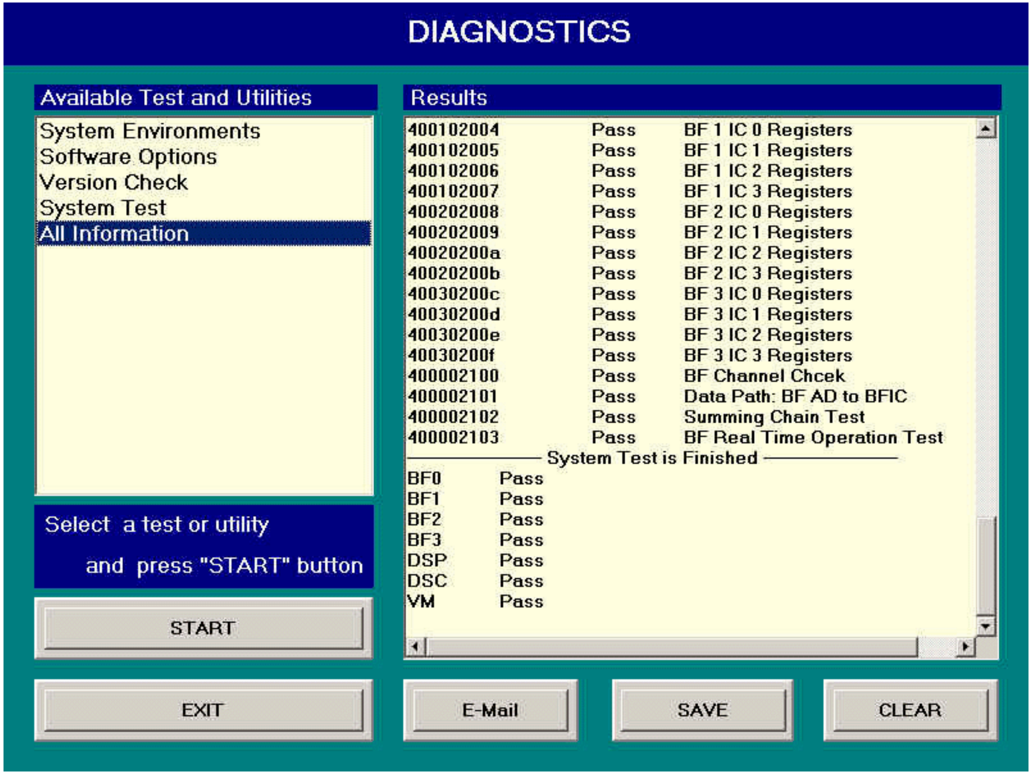
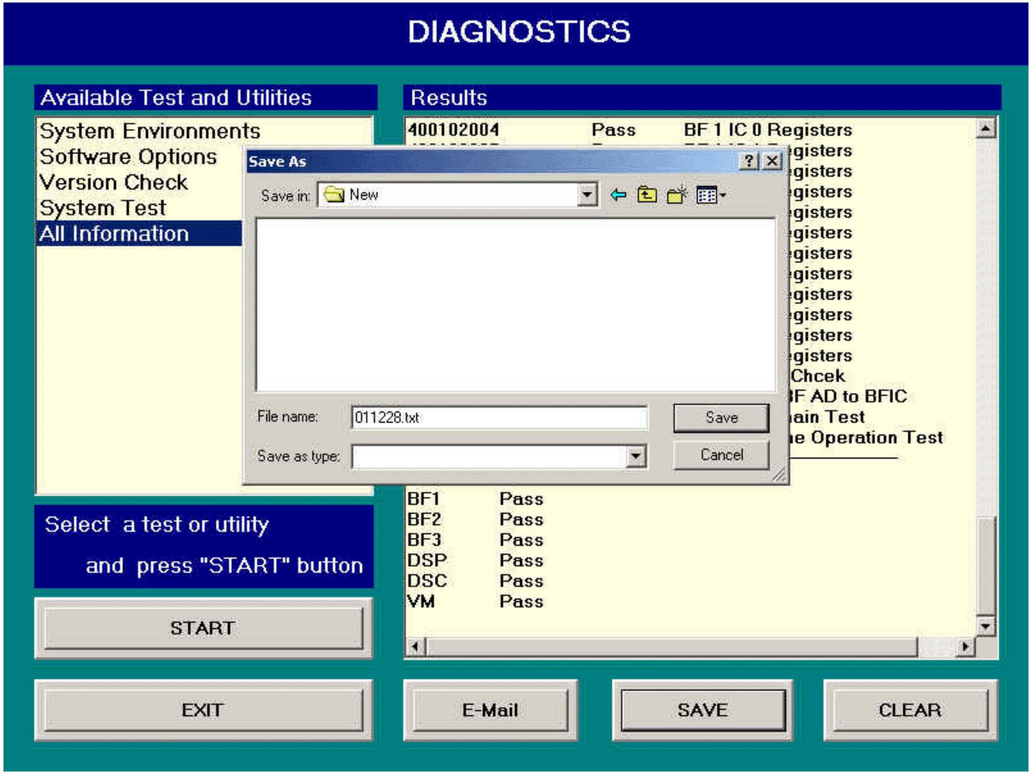


Figure 9-12 Save Results



Checking the Power Supply Voltages

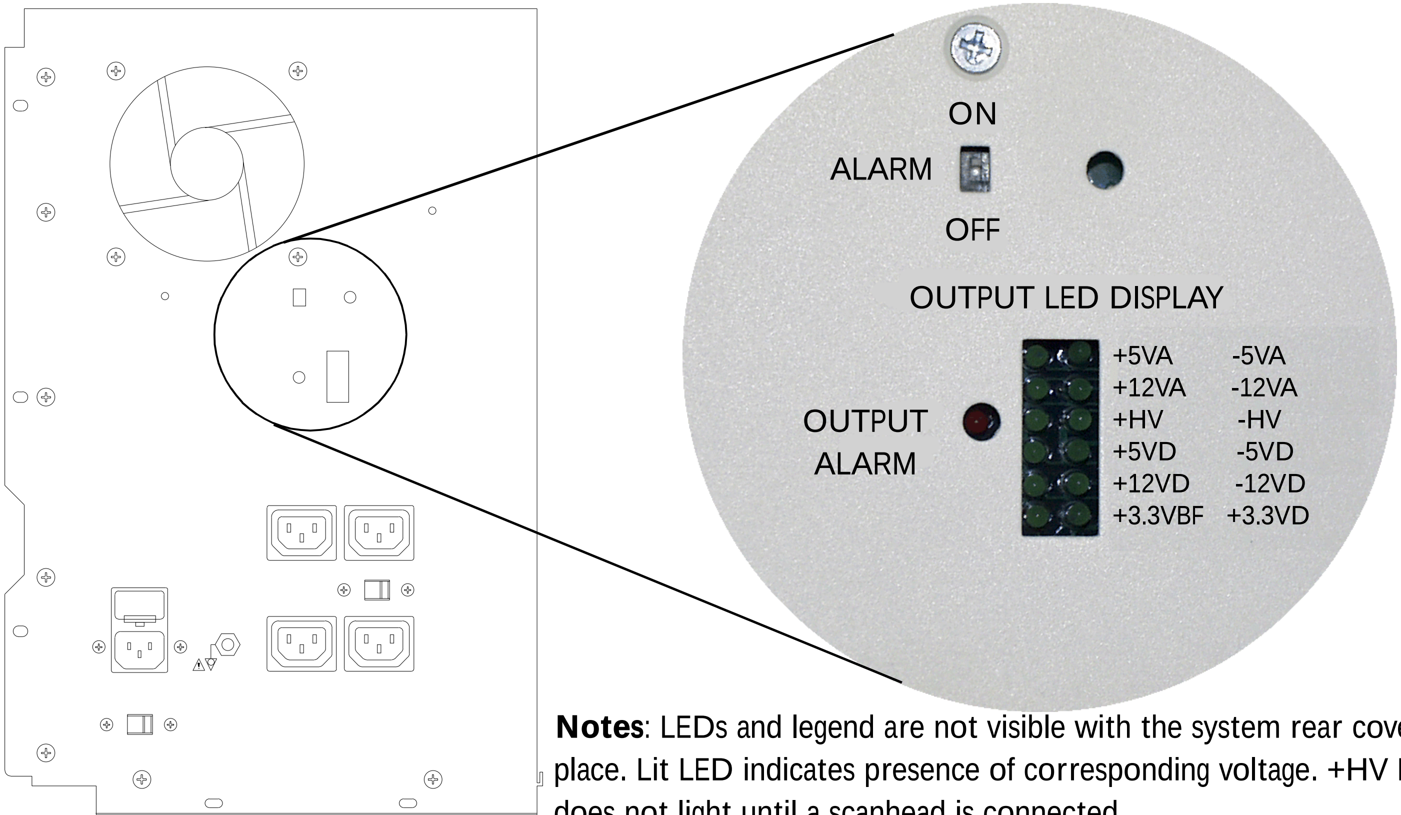
NOTE LEDs on rear of power supply that indicate presence of voltages can only be seen with rear panel removed (Figure 9-13). (See also, "Power Supply Removal" on page 187.)

Measure the Power Supply voltages listed in Table 9-4 at the connectors shown in Figure 9-14.

Table 9-4 Power Supply Voltages

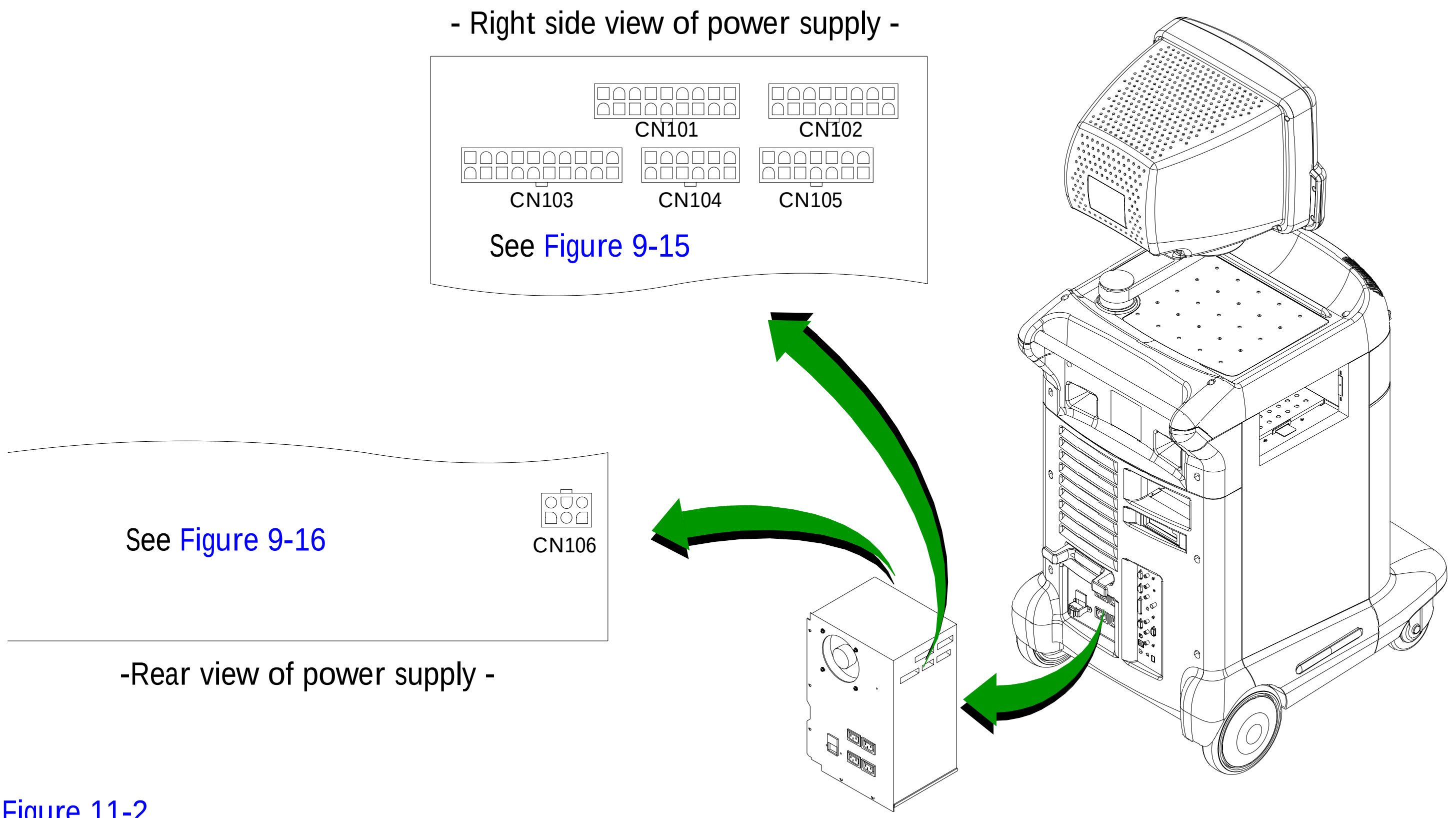
Voltage	Tolerance
+5 Vdc	± 50 mV
-5 Vdc	± 50 mV
+3.3 Vdc	± 33 mV
-12 Vdc	± 120 mV
+12 Vdc	± 120 mV
-10 to 80 Vdc(-HV)	Variable Voltage
+10 to 80 Vdc(+HV)	Variable Voltage
0~5 Vdc	Variable Voltage
115 Vac	± 11.5 Vac
240 Vac	± 24 Vac

Figure 9-13 **Power Supply Voltage LEDs**



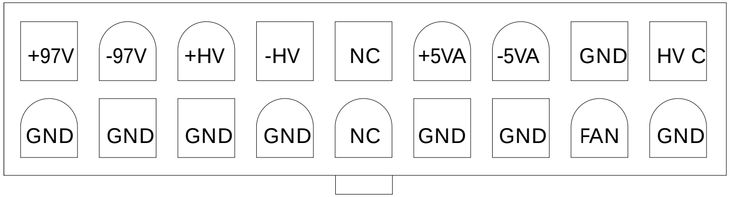
Notes: LEDs and legend are not visible with the system rear cover in place. Lit LED indicates presence of corresponding voltage. +HV LED does not light until a scanhead is connected.

Figure 9-14 **System Power Supply Connector Voltage Map**

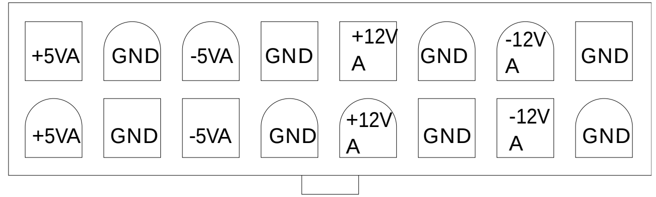


See Figure 11-2

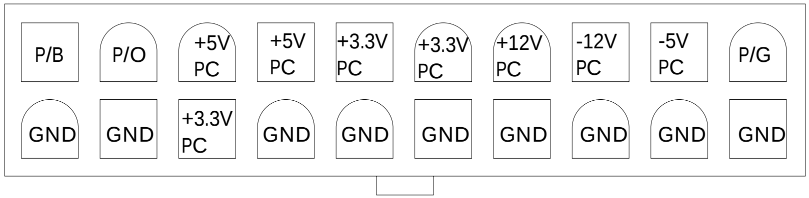
Figure 9-15 Power Supply Connector Voltages (Right Side View)



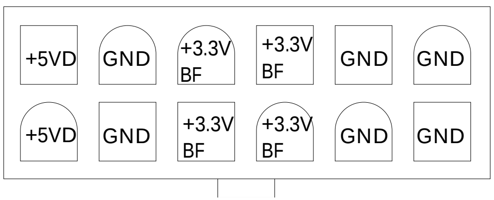
HV power and fan connector (CN101)



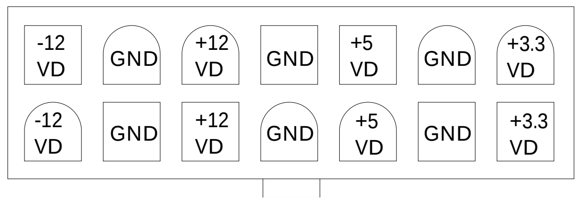
Beamformer analog connector (CN102)



PC power connector (CN103)



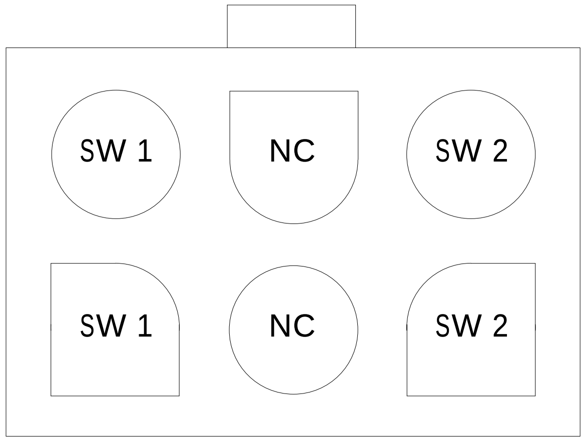
Beamformer digital connector (CN104)



Digital power connector (CN105)

See Figure 9-14

Figure 9-16 **Power Supply Connector Voltages (Rear View)**



Power switch connector (CN106)

See Figure 9-14

Checking for EMI and RFI

Electromagnetic interference (EMI) and radio frequency interference (RFI) can conceivably cause image noise or monitor distortion if the system EMI shielding has been compromised. EMI and RFI can be generated by a variety of electrical devices. The interference can be transmitted over power lines or radiated through the air.

- An operating AM radio tuned between stations around 1,600 Hz can be used as an EMI/RFI source tester. The interference would be noticeable as audible static noise on the radio while walking it around the room. Sometimes EMI/RFI sources are not constant, but are temporary or surge situations that may only occur at certain times.
- Considering and locating the source/cause is important, but regardless of the source, since the system is shielded against EMI and RFI, troubleshoot the system to determined if the EMI/RFI shielding has been compromised. One place to start is to verify that all the system panels are appropriately secured with all their factory-approved screws.

DICOM Trouble-shooting

Three key elements in the network environment must be configured properly for DICOM communications to work:

- Physical data path integrity – The hardware responsible for data transmission (cabling, transceivers, hubs, routers, and switches) must be correct and functional (Figure 5-15, Figure 5-16, and Figure 5-17).
- Correct TCP/IP configuration – The IP addressing, subnet masking, and gateway address for the HDI 4000 and all connected devices must be correct in the Windows setup and in the DICOM device setup screen.
- Correct DICOM configuration – The application entity titles (AE Title) and Port number for the HDI 4000 and all connected devices must be correct.

If a customer's DICOM connection quits working, it is usually because something was changed in the network environment. Use the following steps to help isolate the problem.

NOTE If the DICOM connection worked before, it is typical that either the local information systems department has changed something in the IP environment (such as rerouting data without informing those affected) or there is a hardware failure in the physical data path (such as a bad data cable).

➤ To troubleshoot a DICOM problem

1. Verify that the host table data and network configuration is still correct and that the Network Interface port is enabled on the HDI 4000.
2. Check if there is an obvious problem with the physical data path, such as a broken or disconnected cable (see Figure 5-15, Figure 5-16, Figure 5-17). If you cannot do it on your own, contact the appropriate customer site information or systems administration person to verify the physical data path integrity.
3. If the physical data path is good, verify the data path to the hub, network, or the printer, as appropriate:
   a. On the HDI 4000 system, open a Command Prompt and type in the command "ping *hostname*" (where "*hostname*" is the name of the device, as listed in the system host table, with which the system is trying to communicate).
   b. Press **Enter**. If the path is complete, there will be a response that reads:

      Reply from xxx.xxx.xxx.xxx: bytes=32 time<10ms TTL=128

      Reply from xxx.xxx.xxx.xxx: bytes=32 time<10ms TTL=128

      Reply from xxx.xxx.xxx.xxx: bytes=32 time<10ms TTL=128

      Reply from xxx.xxx.xxx.xxx: bytes=32 time<10ms TTL=128
4. If the previous steps fail, verify that the device in question is online and operational.

5. If there is no problem with the TCP/IP communication, verify the IP address, application entity title, port number, and other host device information.
6. If you have not resolved the issue at this point or if any of the previous steps yielded unexpected results, call your Ultrasound RTAC representative.

➤ To test the system IP configuration

1. Enter the Administrator Mode (as described in "Access the operating system" on page 116).
2. Click **Start**, point to **Programs**, point to **Accessories**, and then click **Command Prompt** (Figure 9-17) to open a Command Prompt window (Figure 9-18).
3. To obtain the IP configuration data, type "ipconfig" and press **Enter**. The IP information will appear as shown in Command Prompt 1 of Figure 9-18. If the *ipconfig* command shows no information, verify that the TCP/IP data for this system was properly configured (To configure the HDI 4000 system for DICOM operations).
4. In the Command Prompt window, ping the IP address of the destination devices and observe the reply as shown in Command Prompt 2 of Figure 9-18. If the **ping** command fails:
   a. Verify that the ultrasound system was restarted after TCP/IP was installed and configured.
   b. Verify that the default gateway IP address is correct and that the gateway (router) is operational, if the system is routed through a gateway.
   c. Verify that the remote host IP address is correct, that the remote host is operational, and that all the gateways (routers) between this computer and the remote host are operational, if the system is routed through a gateway.

Figure 9-17 Opening a Command Prompt Window

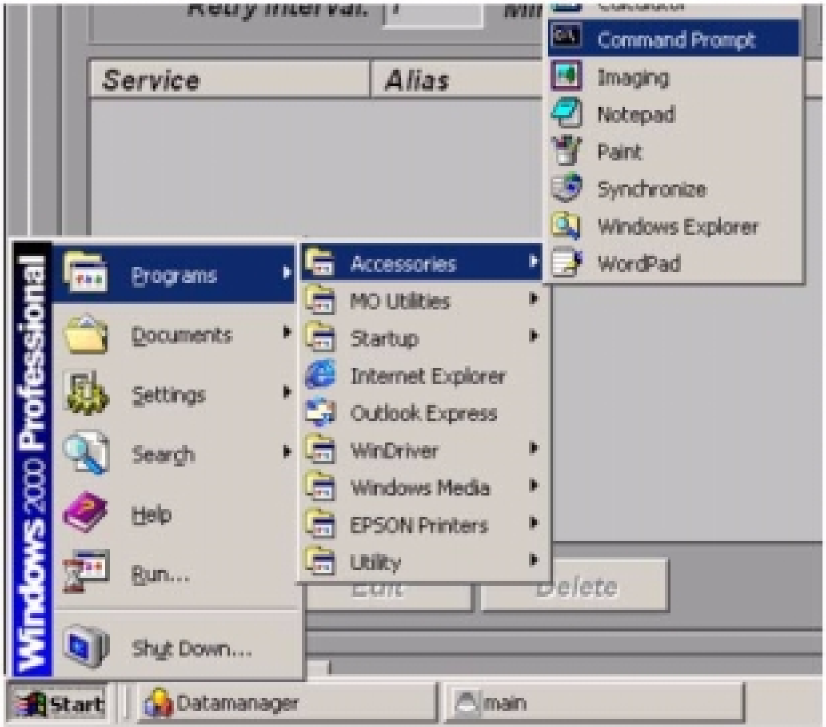
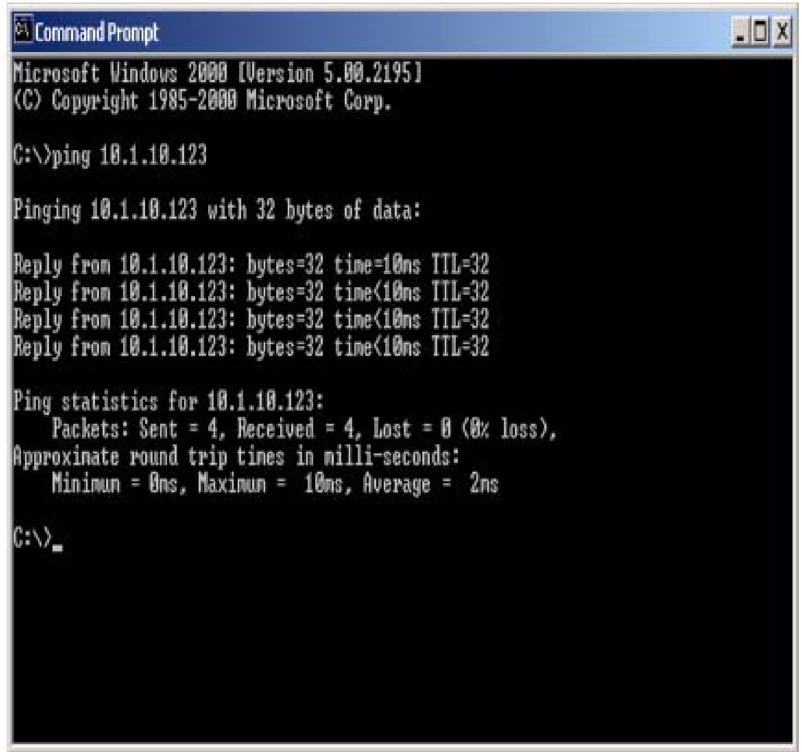


Figure 9-18 Command Prompt Window - IP Configuration and Ping Tests

Command Prompt 1



Command Prompt 2

Backing Up the Ultrasound Images

As described in the following procedure, you can use an MO disk or CD-R/W disk to back up ultrasound images. If it becomes necessary to restore the backed up images to a hard drive, see “Restoring the Ultrasound Images from a Backup Disk” on page 180.

Equipment Required

You will need formatted MO disks or CD-R/W disks, the quantity of which depends on the size and number of the ultrasound images.

Backup Procedure

➤ **To back up the ultrasound images**

1. Verify that the system is connected to an AC power outlet and that system power is ON.
2. Insert a CD-R/W disk into the system CD-R/W drive or a formatted MO disk into the system MO disk drive.
3. Acquire ultrasound images. Press **FREEZE**.
4. Press **STORE** several times to save several images.
5. Press **REVIEW**, click **OPEN** and then **Current Exam**. The images that you have scanned should appear.
6. Click **Backup**.
7. The Backup dialog box appears, prompting you to select the MO or CD-R/W. After selecting one, the system begins to backup the exams.

NOTE If the disk space required is greater than the space available, a message will be displayed informing you of that and asking if you want to proceed. If you select **Yes**, after a disk becomes full, the system will prompt you for more removable media.

Restoring the Ultrasound Images from a Backup Disk

As described in the following procedure, restore the ultrasound images that have been backed up to a MO disk or CD-R/W disk as described in "Backing Up the Ultrasound Images" on page 179.

Equipment Required

You will need the correct MO disk or CD-R/W disk containing the backup ultrasound images.

Restore Procedure

➤ **To restore the ultrasound images to the system hard drive**

1. Verify that the system is connected to an AC power outlet and that system power is ON.
2. Insert the removable media in the drive and wait for it to become ready.
3. Press **REVIEW** and click **Open**. The Exam List window appears.
4. To see the ultrasound images stored on the removable media, click the MO or CD-R/W from the Drive pulldown menu. The exams from the removable media appear on the Exam List and **Backup** changes to **Restore**.
5. After selecting the exams, users can view, delete, and transfer the exams.
6. Click **Restore** to copy exams from the removable media to the local hard drive.

Making the Repair

After you have finished troubleshooting, isolating a fault, and identifying the appropriate repair, perform the authorized corrective action needed. Then conduct the performance tests necessary to ensure the system meets its optimum level of performance.

10 Disassembly and Re-Assembly Notes

Introduction

With the exceptions noted here, most disassembly required for the removal and installation of field replaceable parts, as necessary to troubleshoot the system and implement a repair, can be discerned from the illustrations in Section 13, “Configuration”, and Section 14, “Parts”.

Warnings and Cautions

Review “Safety” on page 40 before any disassembly. Also, heed all additional warnings and cautions contained in this section.

WARNINGS

- Dangerous voltages are present when protective covers are removed. Use extreme caution. Any action taken inside the system must be made by a qualified Philips Ultrasound customer service representative.
- Do not wear ESD wrist straps grounded to the cart when working inside a system with its power turned on.
- Do not replace components with power applied. Under certain conditions, dangerous voltages may exist with power disconnected.

CAUTIONS

- Always use correct ESD procedures. ESD damage is cumulative and may not be noticeable at first. ESD symptoms may be first exhibited as a slight degradation of performance or image quality.
- Always turn power OFF and wait at least 30 seconds before removing or installing any PCB, module, or component.

CAUTIONS

- To avoid damaging the Sony UP-21 printer, be sure to secure the thermal printing head before transporting as described below.
- To avoid system damage, review the information in this section before performing any disassembly or re-assembly activity.

Disassembly for Shipment

Disassembly for shipment consists of disconnecting the scanheads, removing the monitor, removing the hard drive, and correctly packing the system components for shipment. Crating instructions are provided with the crate shipping materials, but are essentially the reverse of the unpacking instructions ("Unpacking the System" on page 85).

Remove any scanheads connected to the system and package them in the original or equivalent shipping containers using packaging methods appropriate for protecting delicate electronic equipment during shipment.

Preparing the Sony UP-21 for Transport

➤ **To secure the Sony UP-21 print head for transport:**

1. Remove the ink ribbon and paper tray.
2. Turn on the printer power.
3. Simultaneously press the **CURSOR** and **MENU** controls. The message "TRANSPORT MODE" appears in the printer display, and the printer operation tone sounds for about two seconds.
4. When the printer operation tone stops sounding, turn off the printer power. The print head is now secured for transport. (The print head is released for operation the next time printer power is turned on, allowing access for ribbon installation)

System Panel Removal and Installation

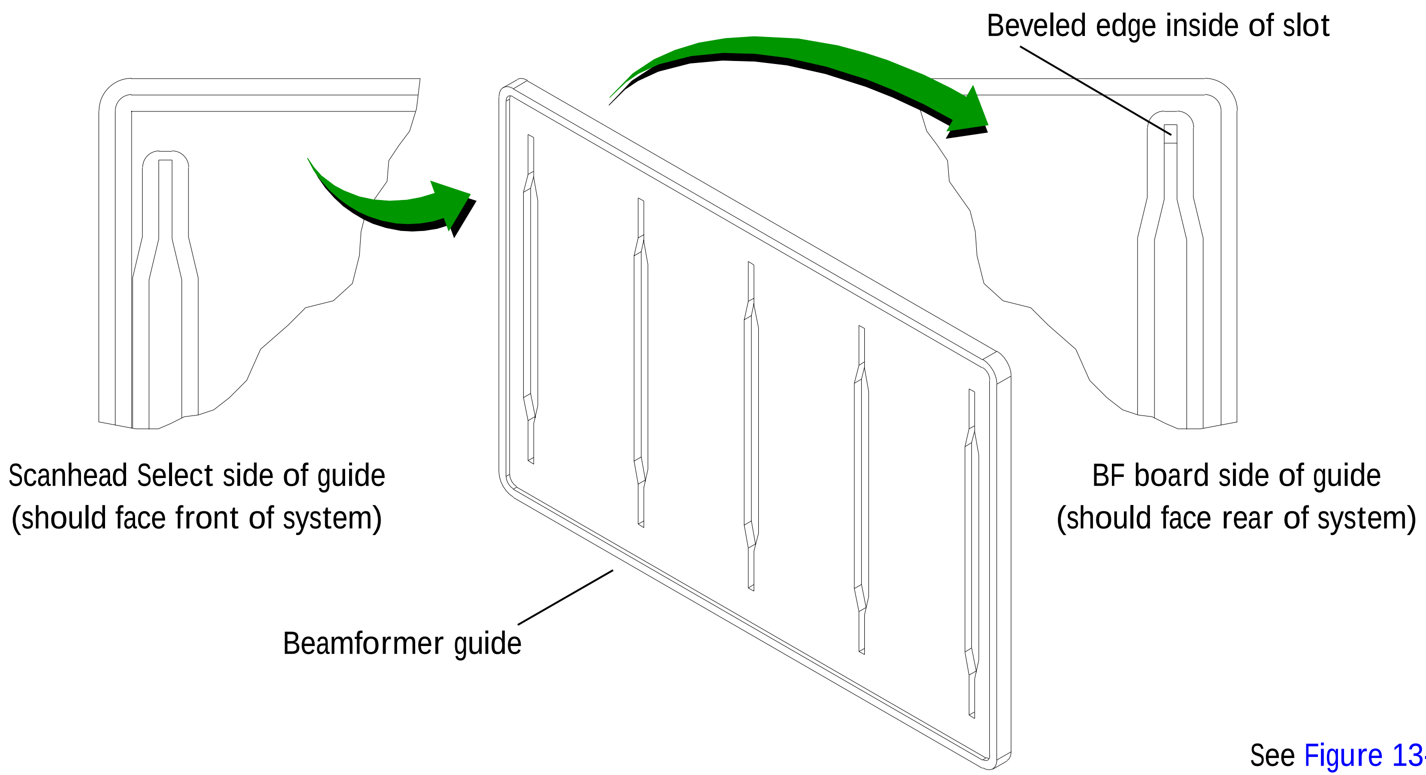
When removing the rubber plugs (Figure 14-6, Figure 14-17, Figure 14-18) for panel screw access, it is important to return each plug to the location and position from which it was removed. The plugs are not identical. It is suggested to use a ballpoint pen to mark the bottom of each plug in some way that will help you remember where it goes when completing re-assembly of the system.

Front End/ PSA Removal and Installation

When removing or re-assembling the front end/Probe Selector Assembly:

- It is necessary to remove only the eight outer-edge screws. Note that there are different length screws. It is important to return each screw to its original location when re-assembling.
- Mark the BF PCB alignment guide/spacer (Figure 14-22) so that when you re-assemble the front end/Probe Selector Assembly, the BF PCB guide/spacer is installed correctly. The beveled edge of the slots that the BF PCB edge connectors pass through should face **into** the system/card cage (Figure 10-1).
- Use the guide pins to help align the PSA when re-assembling.
- Start all mounting screws before tightening and then tighten, but don’t over-tighten, the screws in an alternating pattern.

Figure 10-1 **Beamformer Guide Install Orientation**



See Figure 13-1

Primary Card Cage PCBs Removal and Installation

The following hints may prove helpful when removing and installing the front card cage PCBs (Figure 13-3, Figure 14-22).

Access

Only the system front panel (Figure 14-22) needs to be removed for the removal and installation of all card cage PCBs except the Motor Controller.

BF0 through BF3

CAUTIONS

- When removing the Beamformer PCBs, to avoid damaging PCBs and grounding hardware, ALWAYS remove them in the following sequence: BF3, BF2, BF1, BF0
- When installing the Beamformer PCBs, to avoid damaging PCBs and grounding hardware, ALWAYS install them in the following sequence: BF0, BF1, BF2, and BF3.

CW

CAUTION

You must remove all of the Beamformer PCBs (as described above) before removing the CW PCB to avoid damaging PCBs and grounding hardware.

Motor Controller

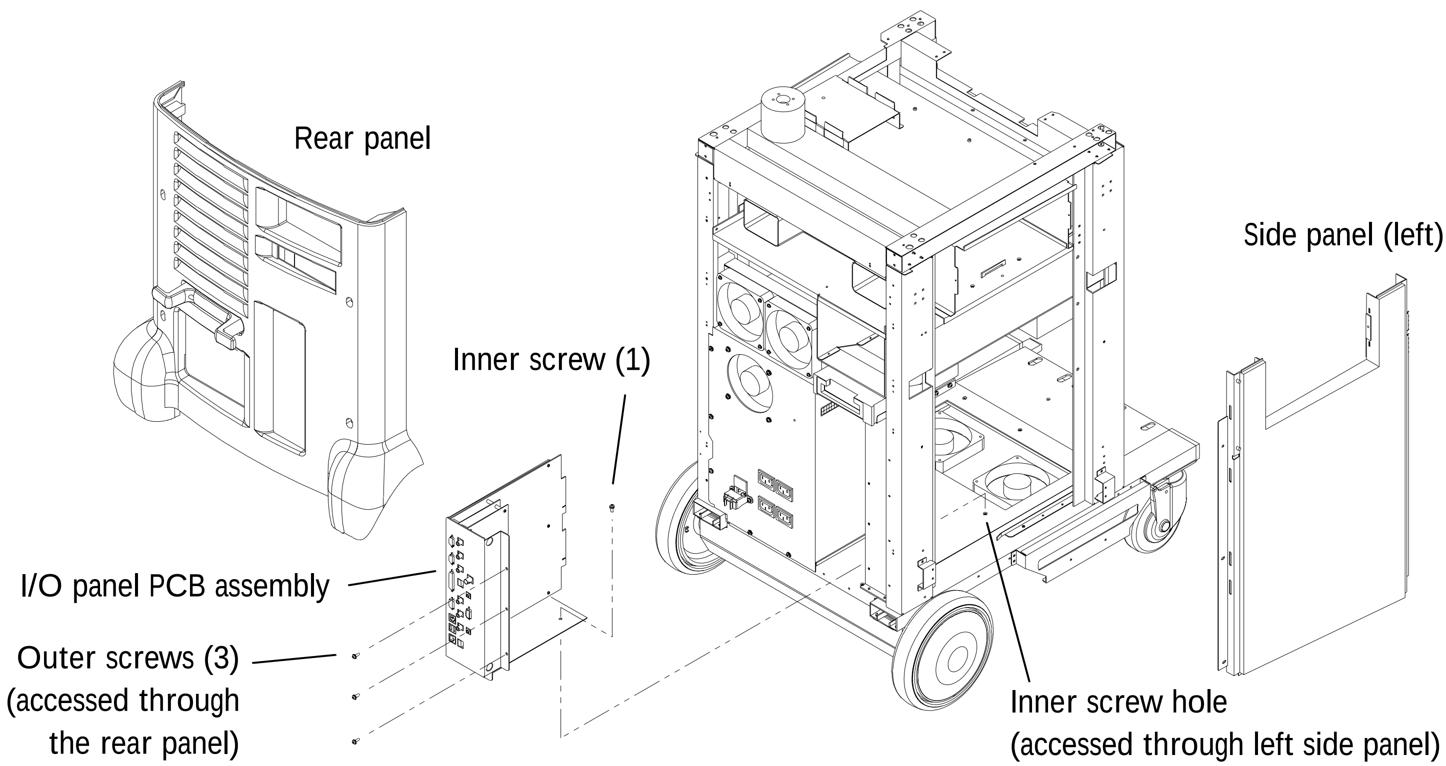
All but the right side panel (when facing system) needs to be removed

Rear I/O Panel PCB Assembly

To remove the rear I/O panel, you need to remove the rear and left side panels first to gain access to the mounting screws for the I/O panel. There are four mounting screws that secure

the rear I/O panel: three outer screws on the backside (accessed through the rear panel) and one inner screw that secures the assembly to the lower frame (accessible only from the left side panel) (Figure 10-2).

Figure 10-2 I/O Panel PCB Assembly Removal



Control Panel Removal

The control panel top (Figure 14-11) is removed by removing eight screws from the bottom (Figure 14-12).

ECG/Power Switch Assembly Removal and Installation

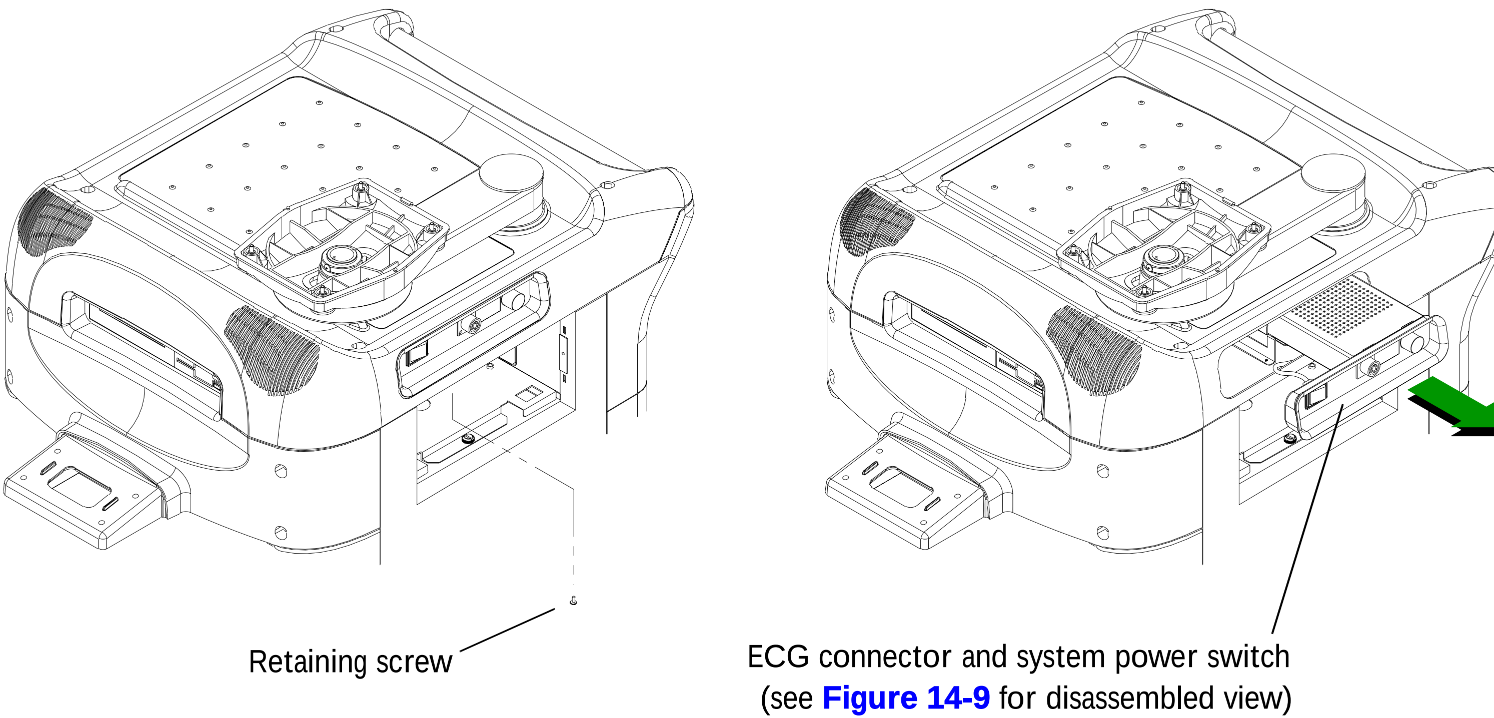
The ECG/Power Switch assembly is secured by one retaining screw at the bottom of the assembly (Figure 10-3).

Power Supply Removal

NOTE LEDs on rear of the power supply that indicate presence of voltages can only be seen with rear panel removed (Figure 9-13).

It is highly recommended that you remove the left side cover panel (as seen when facing the front of the system), as well as the rear cover panel when removing the power supply.

Figure 10-3 **ECG/Power Switch Assembly Removal**



Wheel Cap Removal and Installation

CAUTION Do not try to pry the wheel caps off. The wheel caps (Figure 14-33) are not "press fit" only; they are also attached with three screws from the backside of the wheel.

➤ To remove a wheel cap:

1. Position the wheel so that you can reach the wheel cap mounting screws through the access holes on the back of the wheel (Figure 14-33).
2. Remove the screws from the standoffs and then, from the back side of the wheel, unhook the clips anchoring the wheel cap to the wheel (Figure 14-33).

➤ To install a wheel cap:

1. Line up the wheel cap screw standoffs with the access holes on the back of the wheel and attach the wheel cap onto the wheel, snapping the anchoring clips into the slots on the wheel (Figure 14-33).

NOTE The wheel cap must be in the proper orientation before the anchoring clips and standoffs will align with their corresponding slots and access holes.

2. From the back side of the wheel, thread the mounting screws through the access holes into the wheel cap standoffs and tighten.

11 Cabling

Introduction

This section contains system cable interconnect information.

System Interconnection

Figure 11-1 is an overall system cabling diagram. Figure 11-2 is a power distribution diagram. Figure 11-3 through Figure 11-9 are illustrations of the system primary connector assemblies. Figure 11-10 through Figure 11-13 are cabling diagrams for OEM peripherals. Figure 11-14 identifies the chassis ground cable.

Cable Part Numbers

Table 11-1 is a parts list of the interconnect cables, Table 11-2 is a parts list of the power distribution cables, and Table 11-3 is a parts list of the OEM peripheral cables.

Figure 11-1 **System Signal Cable Interconnect Diagram**

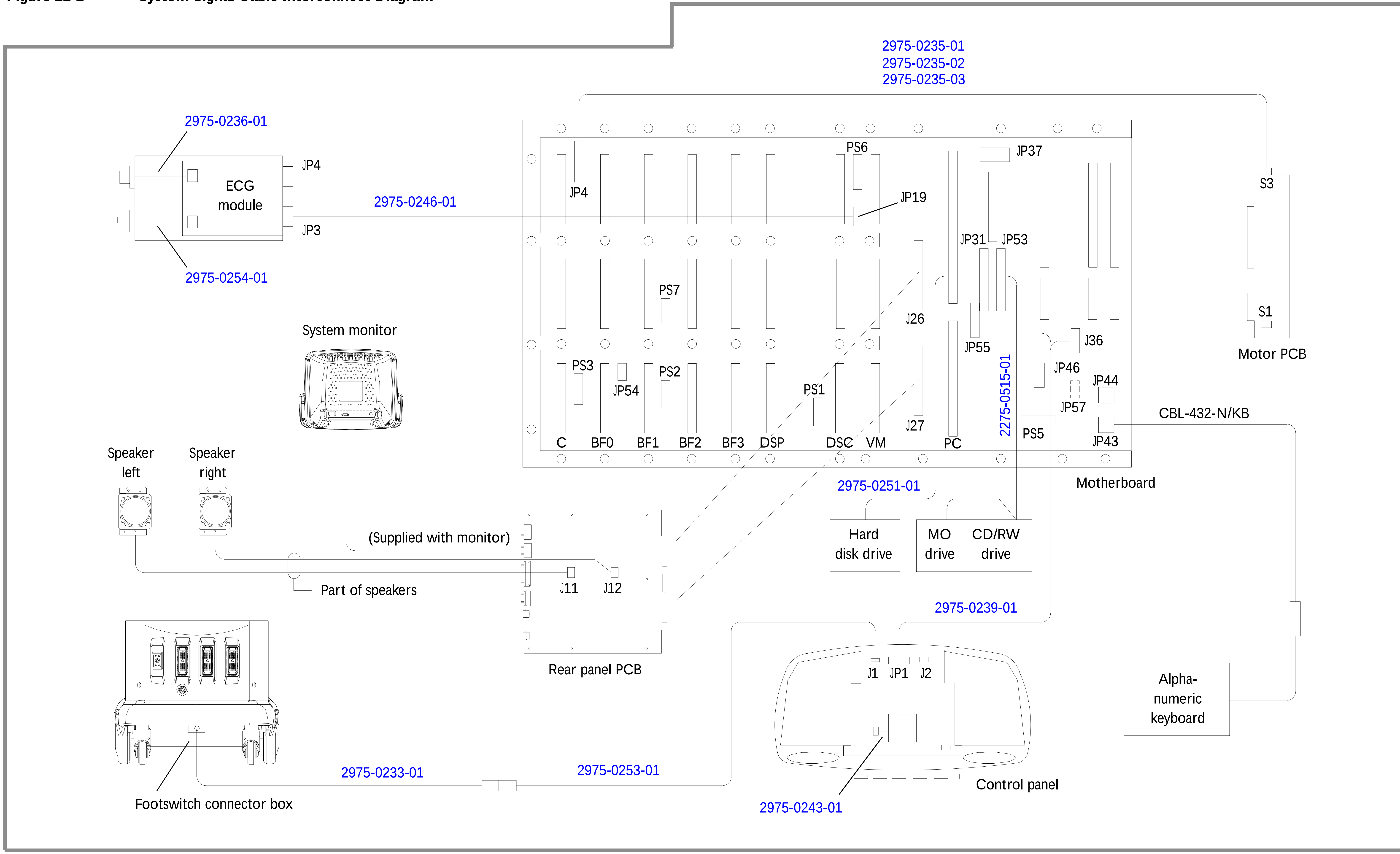
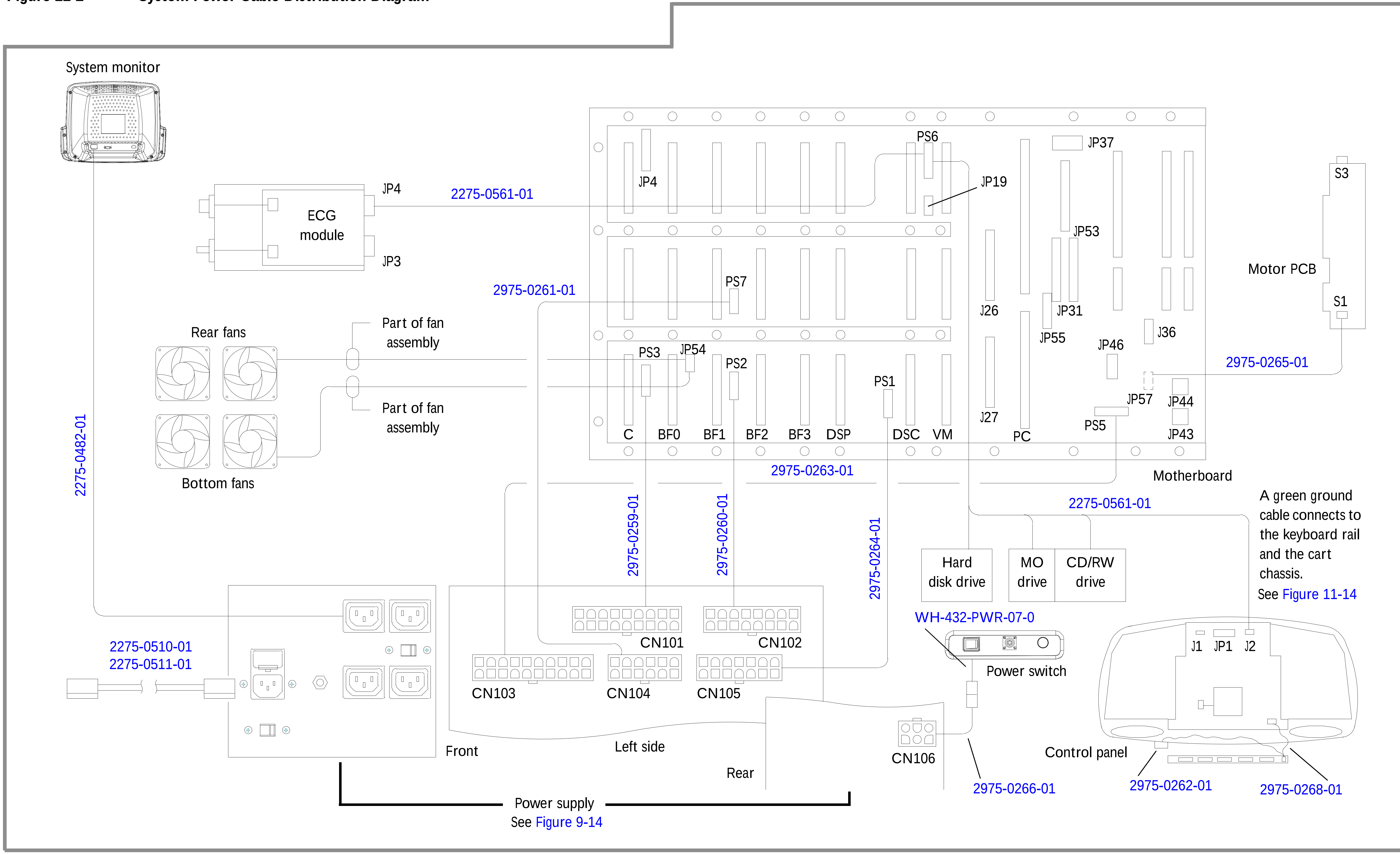


Figure 11-2 System Power Cable Distribution Diagram



Connectors and Cabling Diagrams

Figure 11-3 **Probe (Scanhead) Connection Panel**

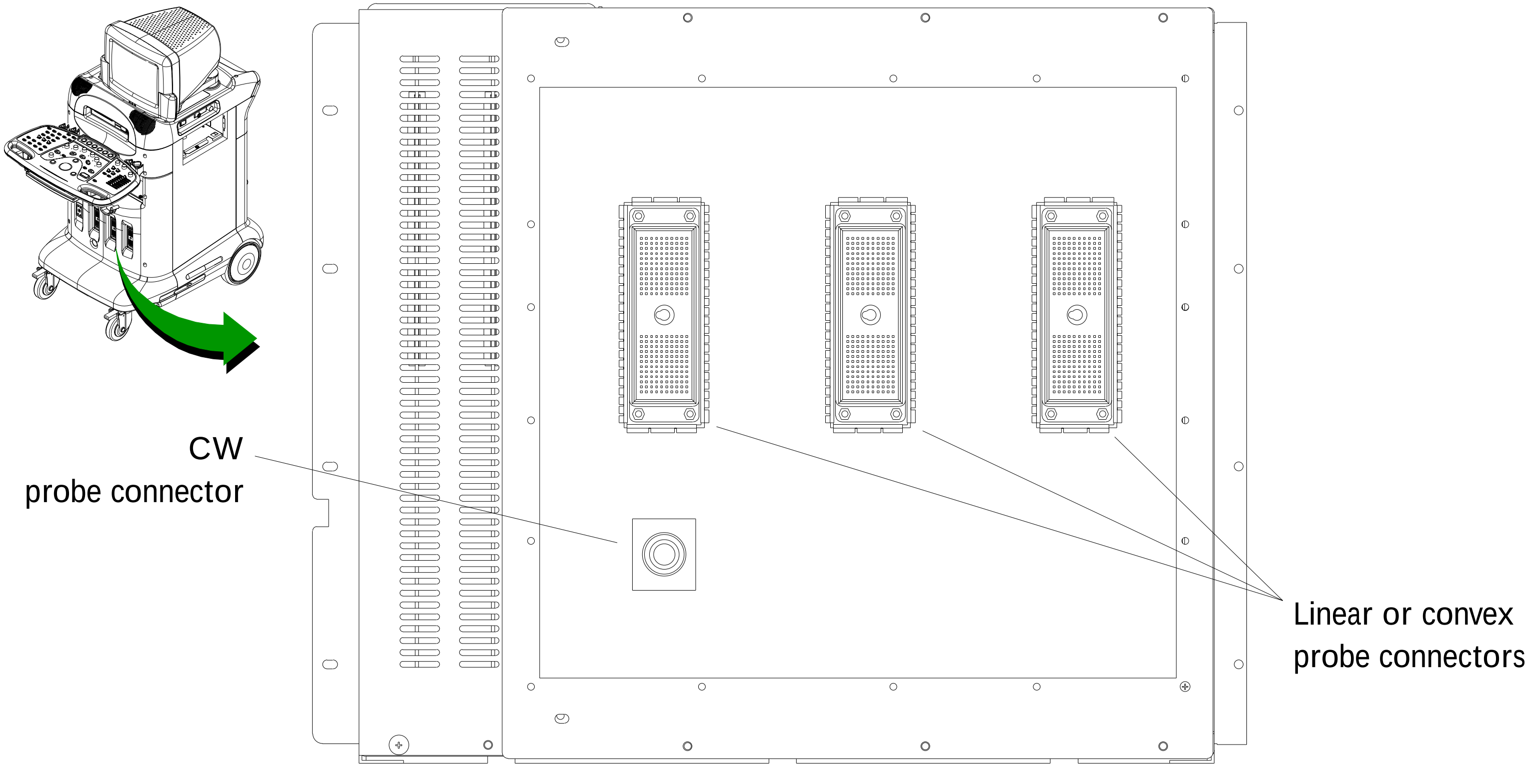
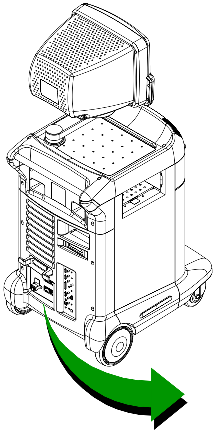


Figure 11-4 AC Power Connection Panel



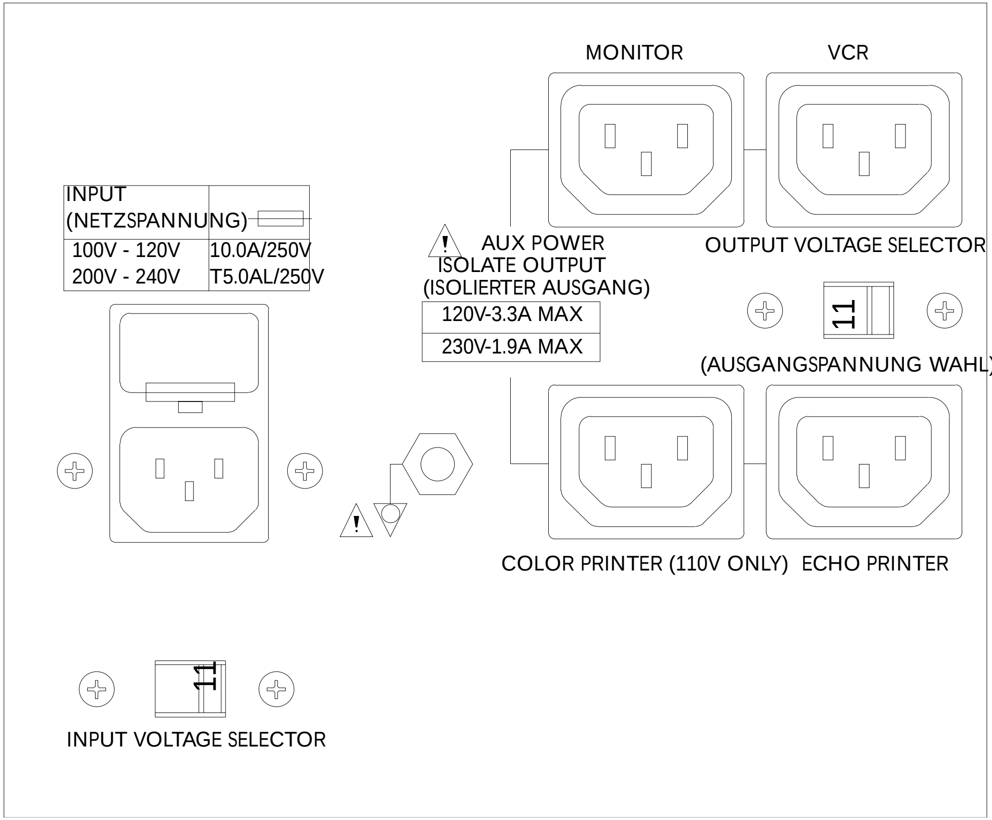


Figure 11-5 **Rear I/O Connection Panel**

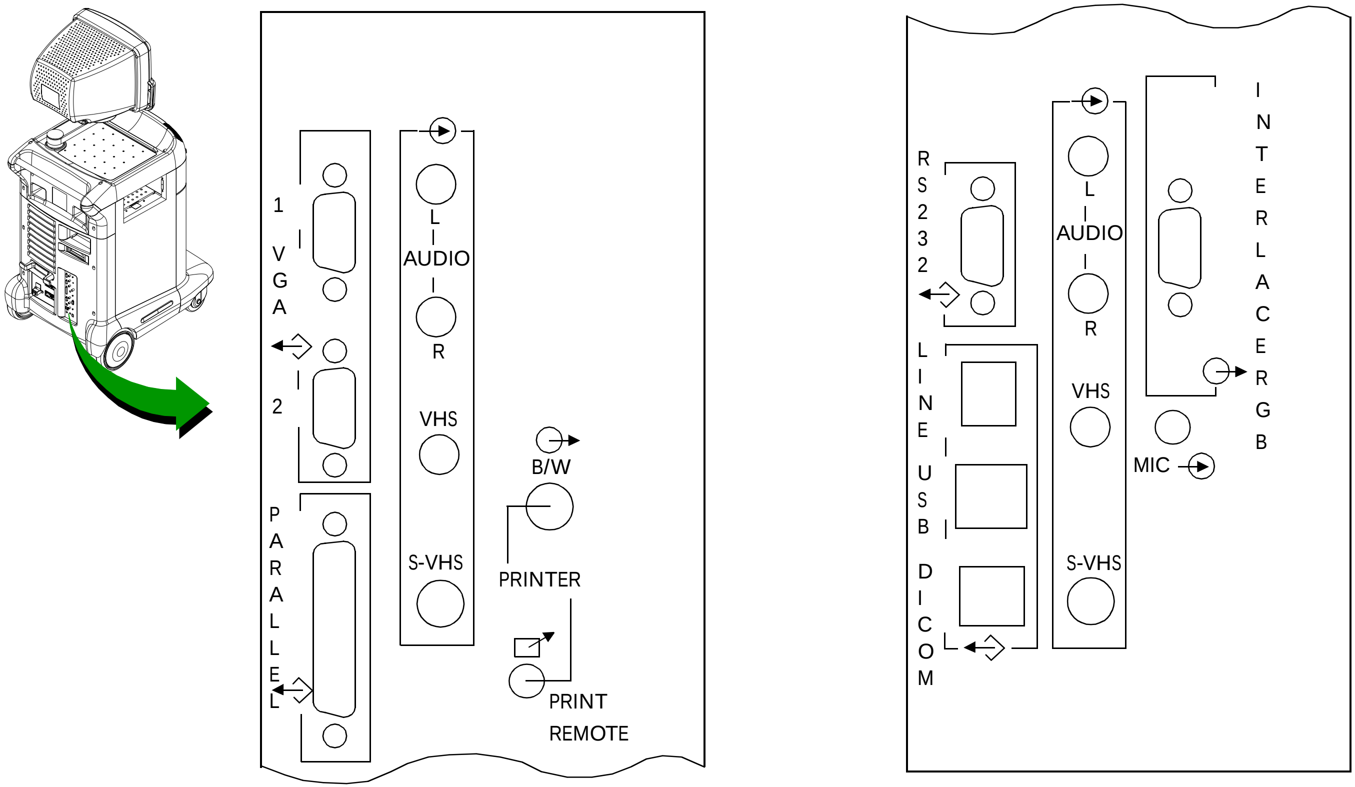


Figure 11-6 Power Supply Connection Panel (Back Side)

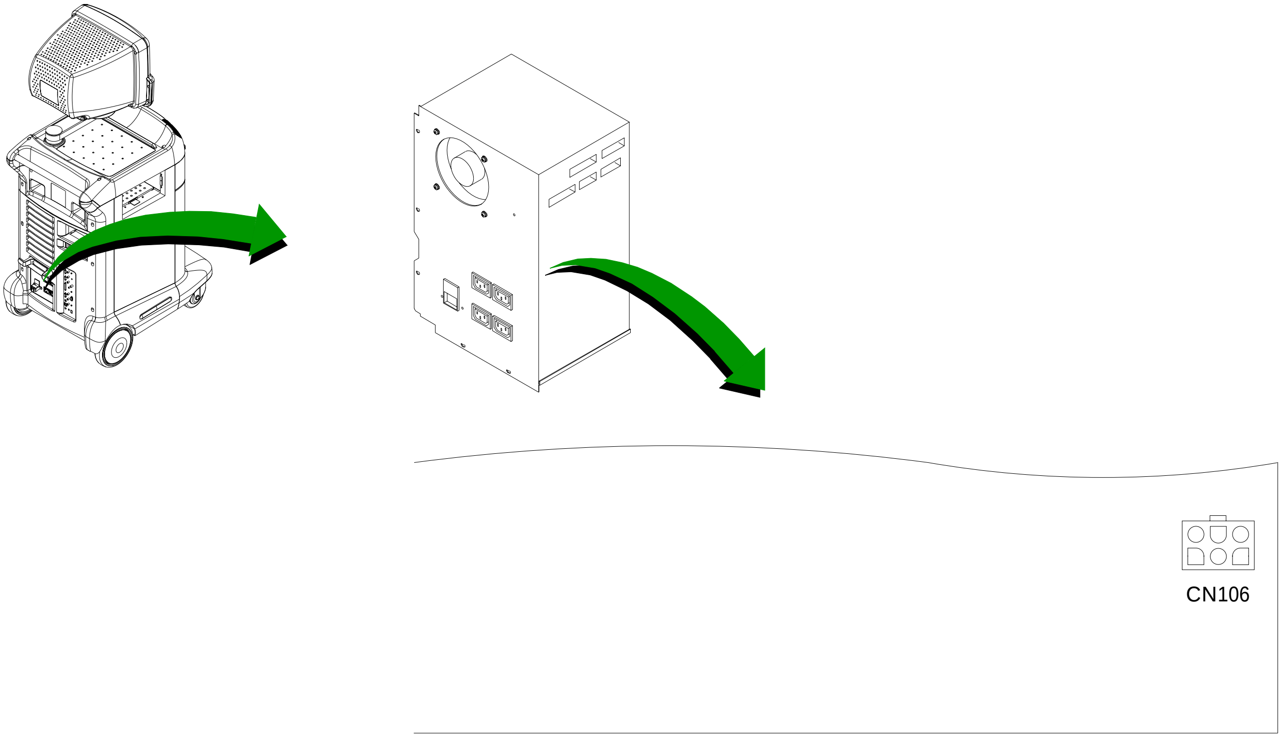


Figure 11-7 Power Supply Connection Panel (Right Side)

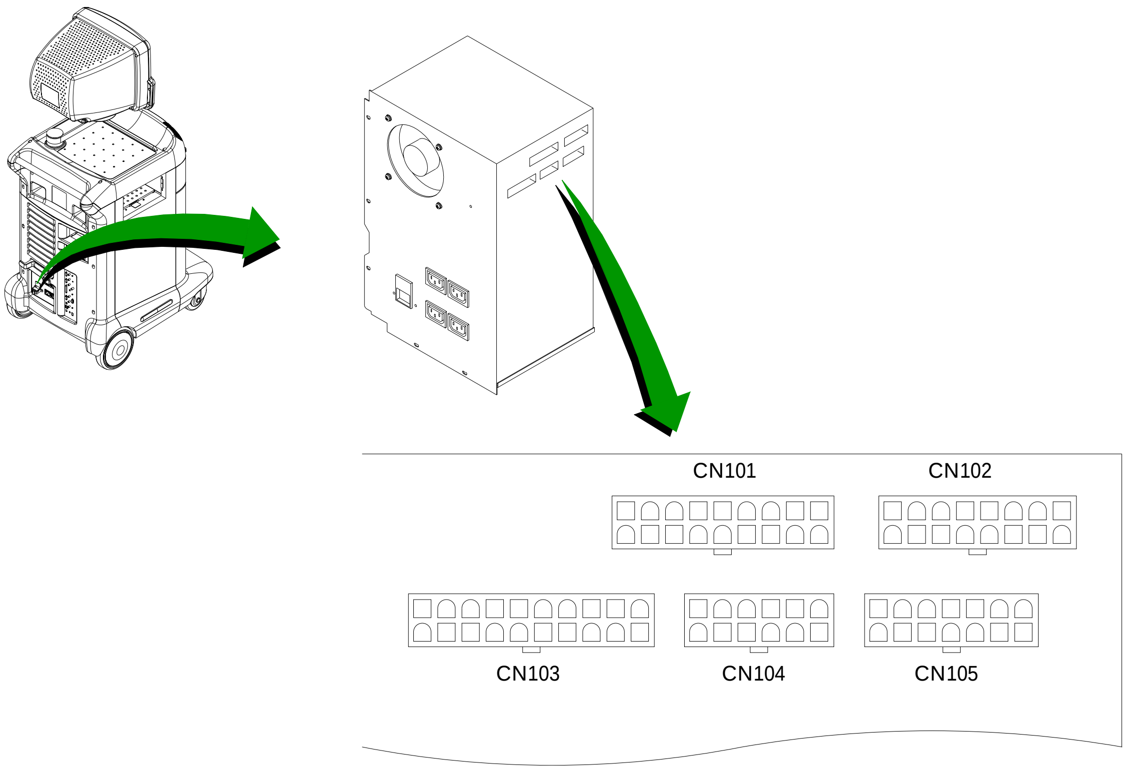


Figure 11-8 **Motherboard Backplane (Front View)**

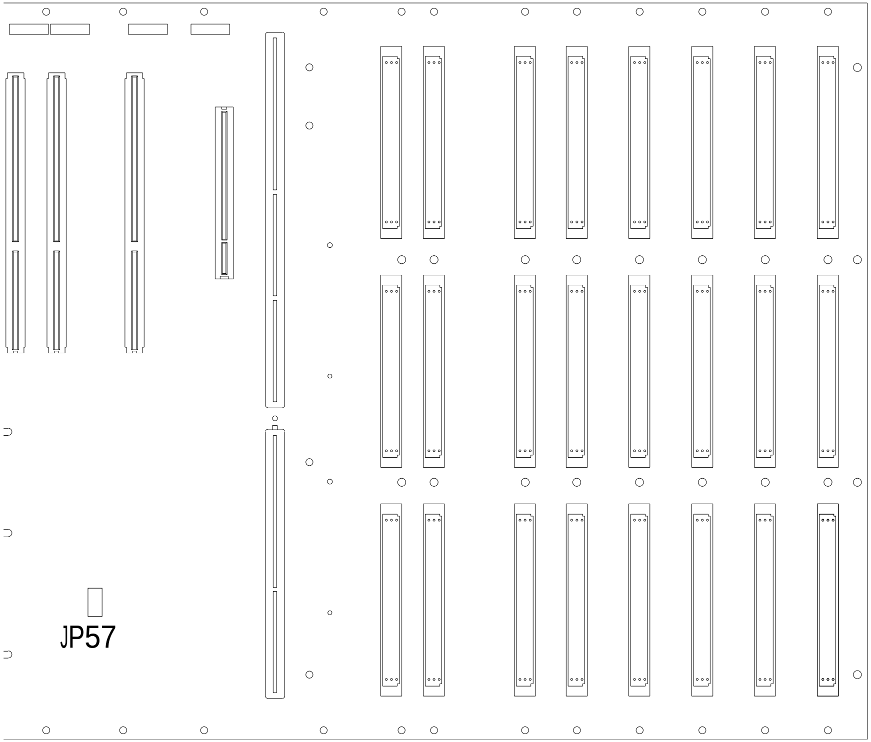


Figure 11-9 **Motherboard Backplane (Back View)**

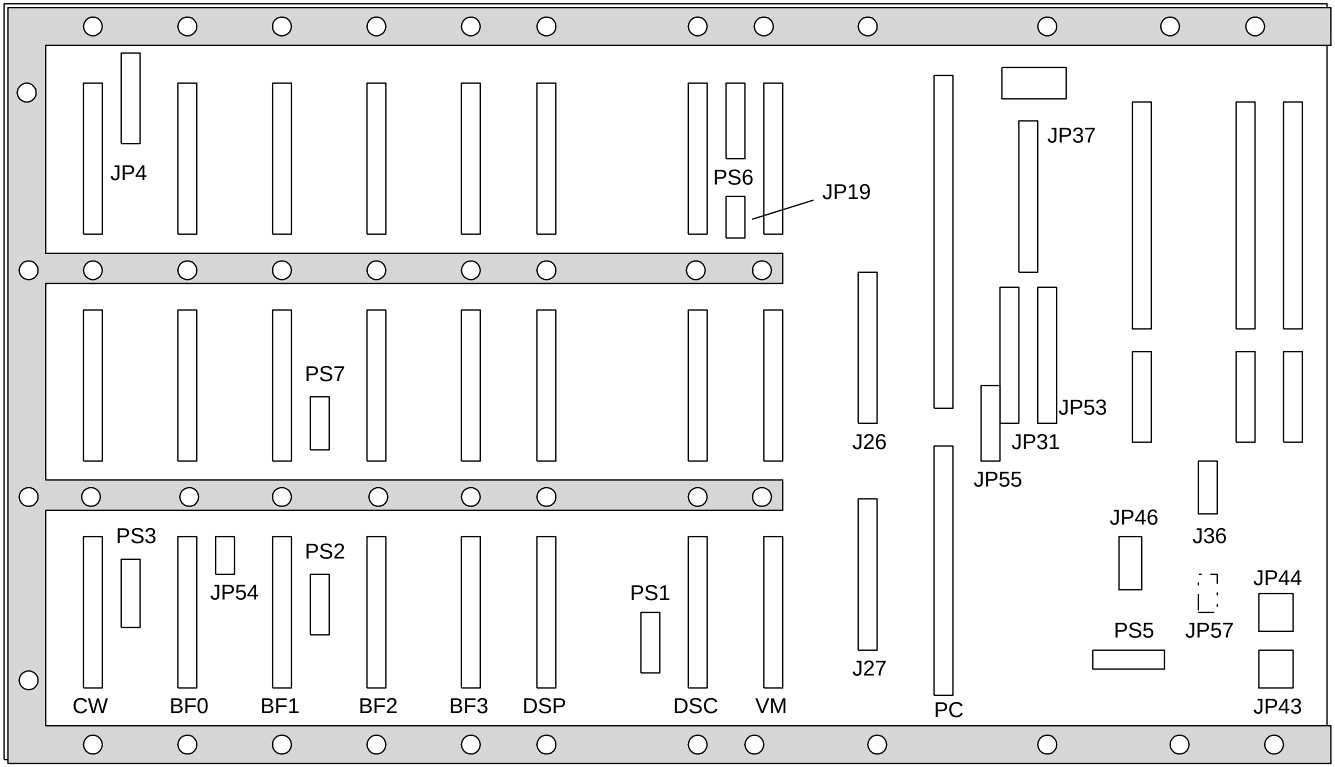


Figure 11-10 UP-21MD Color Printer Cabling Diagram

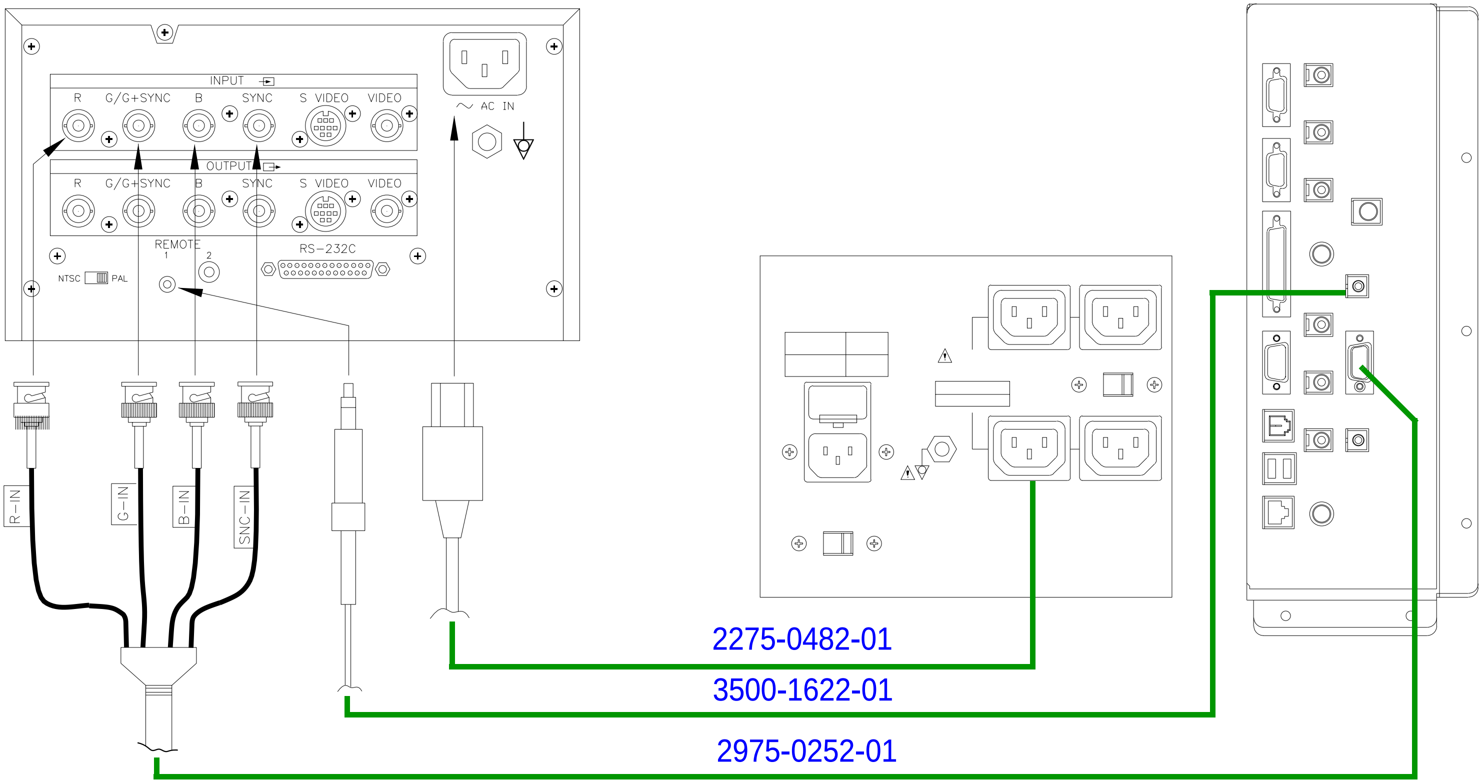


Figure 11-11 CP800E/UM Color Printer Cabling Diagram (External Only)

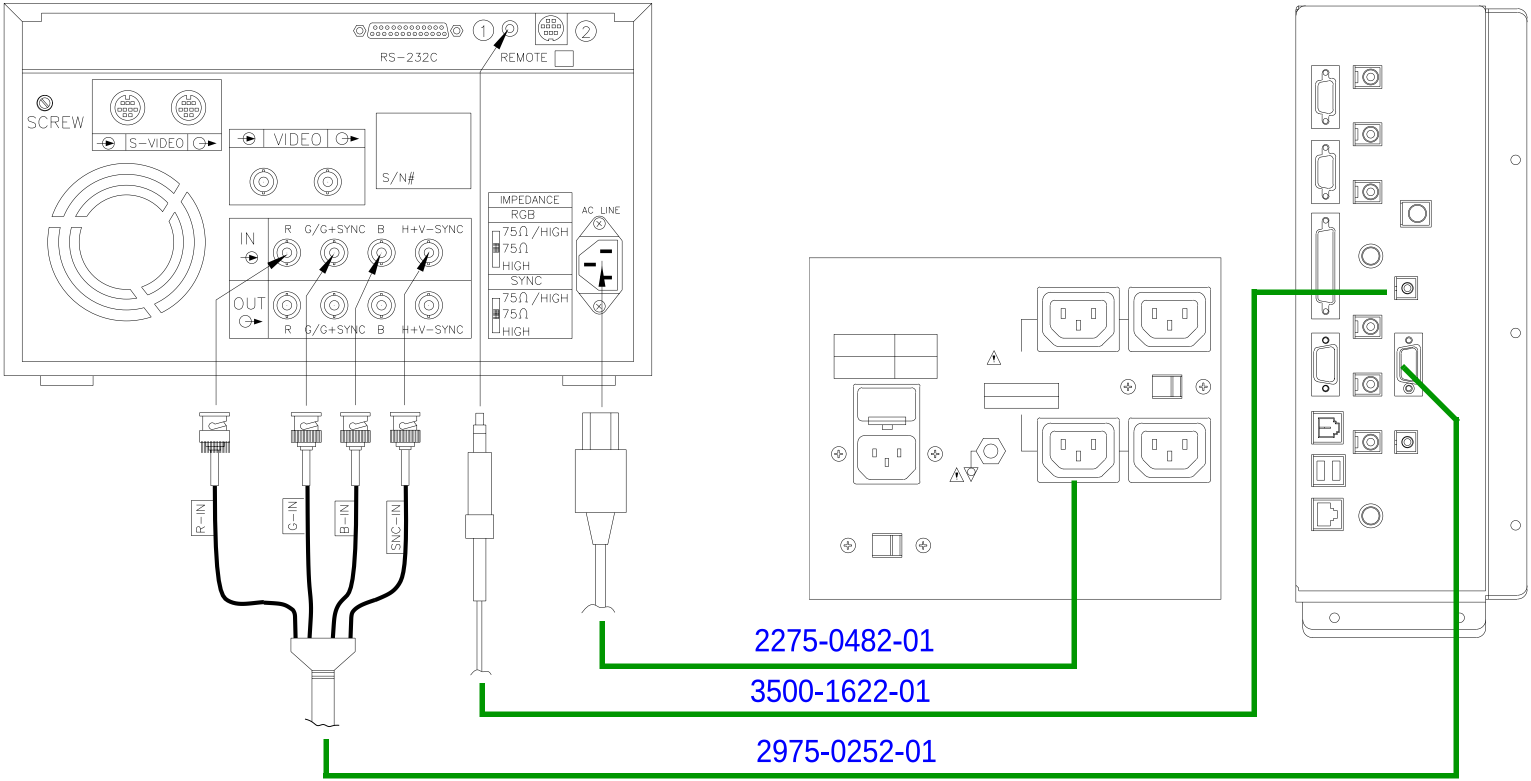


Figure 11-12 **UP-895MD Black and White Printer Cabling Diagram**

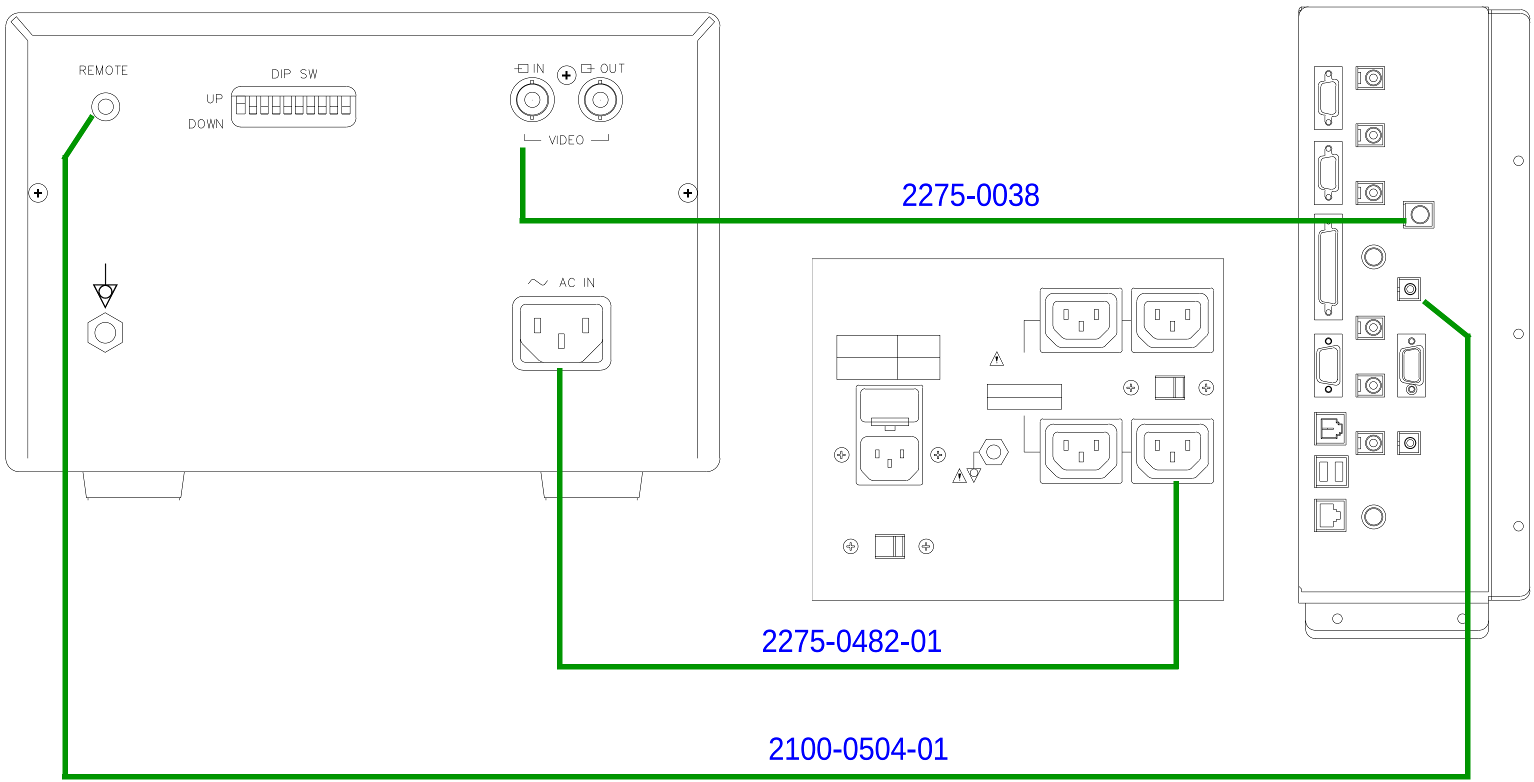


Figure 11-13 AG-MD835E/P VCR Cabling Diagram

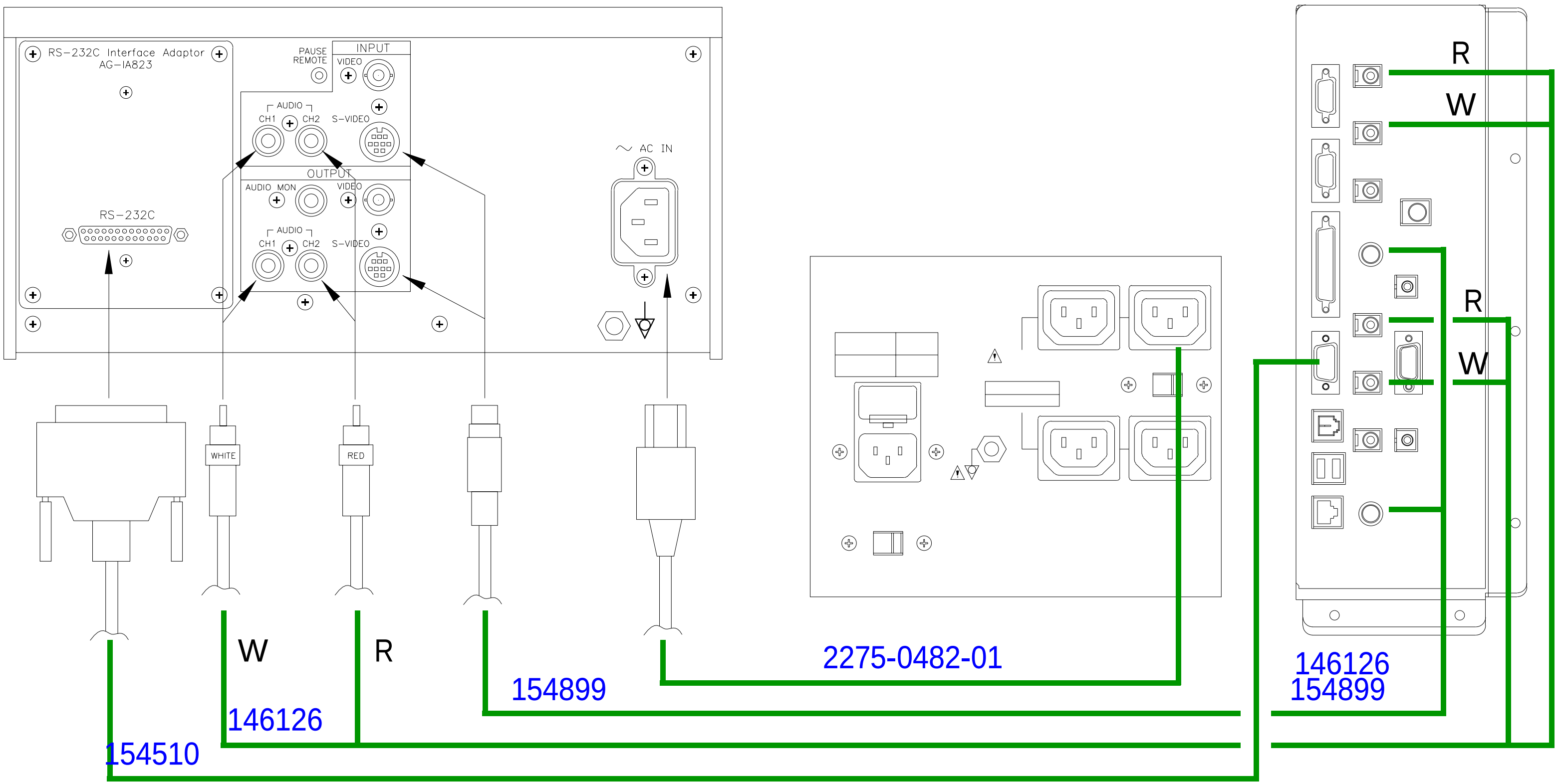
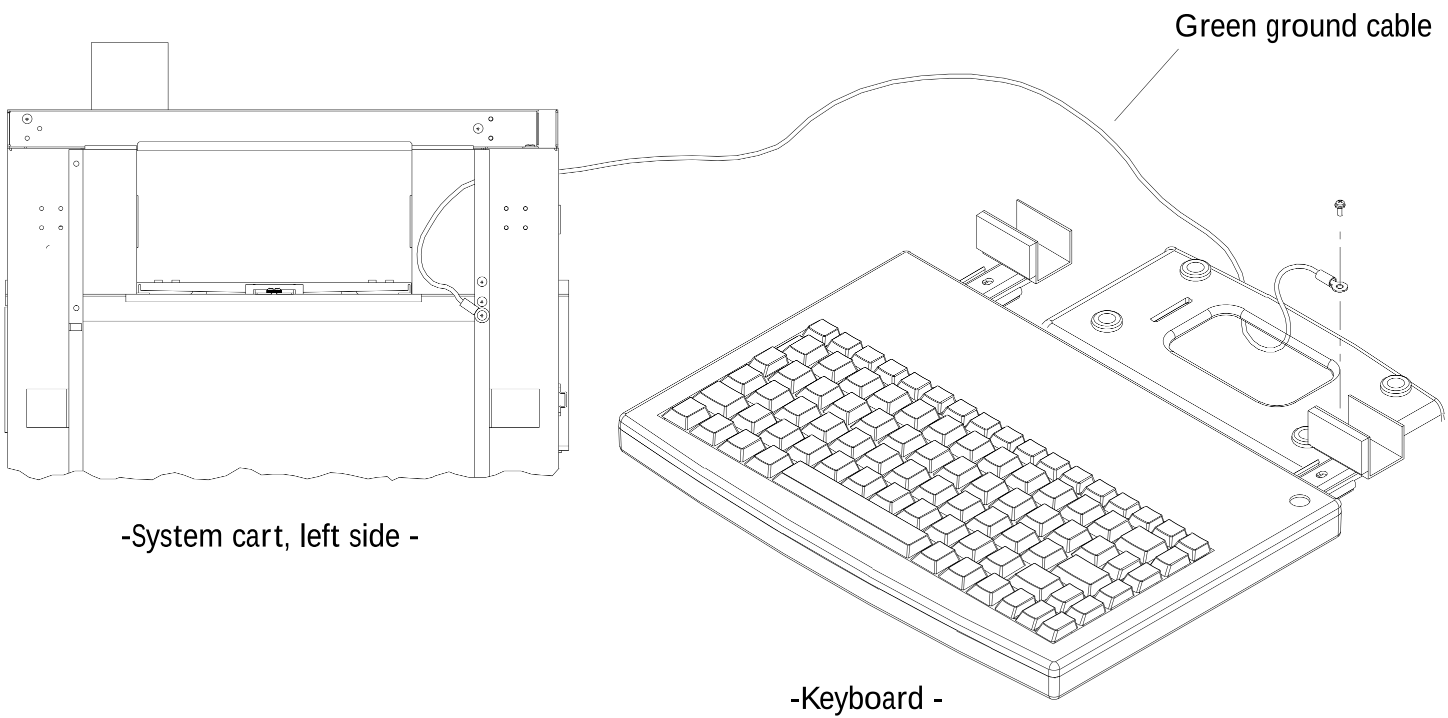


Figure 11-14 **Ground Cable Location (2275-0516-01)**



Part Number Tables

Table 11-1 HDI 4000 Signal Interconnect Cables

Part Number	Cable Description (See Figure 11-1 unless otherwise noted)	Notes/Reference
2975-0235-01	Cable Assy, Back Plane, Motor	WH-432-SIG-11-0
2975-0235-02	Cable Assy, Back Plane, Motor	WH-432-SIG-11-01
2975-0235-03	Cable Assy, Back Plane, Motor	(with toroid) WH-432-SIG-11-2
2975-0246-01	Cable Assy, BP, ECG	WH-432-SIG-08-0
2975-0236-01	Cable Assy, ECG Case, ECG B/D	WH-432-SIG-09-0
2975-0254-01	Cable Assy, ECG Case, ECG B/D	WH-432-SIG-10-0
2975-0233-01	Cable Assy, Footswitch, Front Panel	WH-432-SIG-13-0
2975-0253-01	Cable Assy, Footswitch, Key I/F	WH-432-SIG-14-0
2975-0251-01	Cable Assy, HDD, Back Plane	WH-432-SIG-17-0
2975-0239-01	Cable Assy, Key I/F, Back Plane	WH-432-SIG-02-0
2275-0515-01	Cable Assy, MO, CDRW, SA9900	CBL-ATA66M-40P
2975-0243-01	Cable Assy, Trackball, Key Matrix	WH-432-SIG-12-0
2275-0275-01	Cable, ECG, UM4, UM9, 10-foot, LL-2320	(Part of accessory kit) (See Figure 14-35)

Table 11-1 HDI 4000 Signal Interconnect Cables (Continued)

Part Number	Cable Description (See Figure 11-1 unless otherwise noted)	Notes/Reference
2275-0516-01	Cable, Ground	(Part of accessory kit) CBL-GROUND-NEW (See Figure 14-35)
2275-0276-01	Leads, ECG, UM4, UM9, 25-inch L, 42363	(Part of accessory kit) (See Figure 14-35)

Table 11-2 HDI 4000 Power Distribution Cables

Part Number	Cable Description (See, Figure 11-2 unless otherwise noted)	Notes/Reference
2975-0268-01	Cable Assy, Key, Lamp	WH-432-PWR-11-0
2975-0260-01	Cable Assy, Power, BP (BF)	WH-432-PWR-02-0
2975-0261-01	Cable Assy, Power, BP (BF2)	WH-432-PWR-03-0
2975-0259-01	Cable Assy, Power, BP (CW)	WH-432-PWR-01-0
2975-0265-01	Cable Assy, Power, BP, Motor	WH-432-PWR-08-0 (Located inside card cage)
2975-0263-01	Cable Assy, Power, BP (PC)	WH-432-PWR-04-0
2975-0264-01	Cable Assy, Power, BP (VM, DSC, DSP)	WH-432-PWR-05-0
2975-0266-01	Cable Assy, Power Switch, Power	WH-432-PWR-10-0
No Philips P/N	Cable Assy, Power Switch, Switch	WH-432-PWR-07-0
2275-0561-01	Cable Assy, PWR, BP, HDD, Key, ECG, CD-RW	WH-432-PWR-06-0

Table 11-2 HDI 4000 Power Distribution Cables (Continued)

Part Number	Cable Description (See, Figure 11-2 unless otherwise noted)	Notes/Reference
2275-0510-01	Cable Assy, Pwr, Detachable, 110V, 4.5M	(Part of accessory kit)
2275-0511-01	Cable Assy, Pwr, Detachable, 220V, 4.5M	(See Figure 14-35)
2975-0262-01	Cable Assy, Switch, Lamp	WH-432-PWR-12-0
2275-0482-01	Cord, Power, Monitor/Pwr Supply, HDI 1500	(Part of accessory kit) (This power cord is also used on the color printer, B/W printer and the VCR) CORD-316-MNT

Table 11-3 Peripheral Cables

Part Number	Cable Description (See Figure 11-10 through Figure 11-13)	Notes/Reference
Color Video Printer Cables		
3500-1622-01	Cable Assy, Color Printer Remote	
2975-0252-01	Cable Assy, E106261, 4 Color, HDI 4000	(Part of accessory kit) CBL-2990-E106261-C (See Figure 14-35)
No Philips P/N	Cable Assy, Printer Option	(Part of accessory kit) WH-432-SIG-20-0 (See Figure 14-35)

Table 11-3 Peripheral Cables (Continued)

Part Number	Cable Description (See Figure 11-10 through Figure 11-13)	Notes/Reference
Black-and-White Video (Image) Printer Cables		
2100-0504-01	Cable Assy, Remote Control, Sony, RM91	
2275-0038	Cable Assy, BNC, M/M, 36-in	
VCR Cables		
146126	Cable Assy, Dual RCA Plugs, 3-foot	
154510	Cable Assy, RS232, DB9F/DB25M, Modem, 6-foot	
154899	Cable Assy, S-VHS, Shielded, 6-foot	

OEM Peripheral Settings

The initial factory installation settings are listed in Table 11-4 through Table 11-7.

Table 11-4 UP-895 Printer Switch Settings

Front of Printer

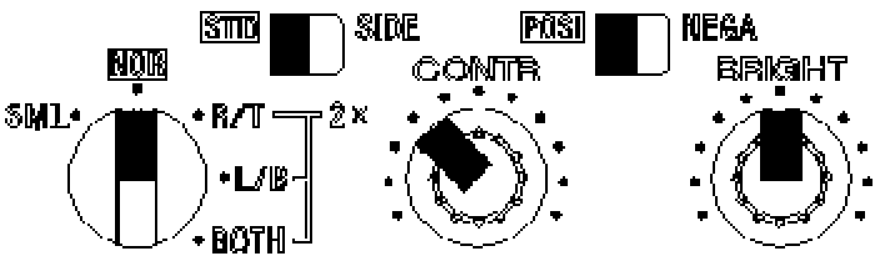


Table 11-4 UP-895 Printer Switch Settings

Inside the Paper Tray	
(The power must be turned on to access the switches inside the paper tray: Press **OPEN** and remove the paper roll.)	
SHARPNESS	II
GAMMA	II
PAPER TYPE	HD
SMOOTHING	OFF
Rear of Printer	
DIP Switches 1-5	Down
DIP Switch 6	Up
DIP Switches 7-12	Down

Table 11-5 UP-21MD Printer Settings

	HDI 4000 Default Settings[1]	
Menus and Parameters	**NTSC Settings**	**PAL Settings**
COL:		
Load Color:	1	
CYN – RED:	0	
MAG – RGB:	0	
YEL – BLU:	0	
Dark:	1	

Table 11-5 UP-21MD Printer Settings (Continued)

	HDI 4000 Default Settings[1]	
Menus and Parameters	**NTSC Settings**	**PAL Settings**
Light:	0	
Sharpness:	8	
Interpol:	OFF	
Save Color:	1 [EXEC]	
LAY:		
Memory:	Frame	Frame
Multi Pix:	1	1
Separate:	*****	*****

Table 11-5 UP-21MD Printer Settings (Continued)

	HDI 4000 Default Settings[1]	
Menus and Parameters	**NTSC Settings**	**PAL Settings**
Window:		
H Start:	-24 Dots	40 Dots
V Start:	-8 Dots	20 Dots
H Width:	976 Dots	840 Dots
V Width:	480 Dots	496 Dots
Save:	Press [EXEC]	Press [EXEC]
Caption:	OFF	OFF
PRN:		
Print QLT:	1	1
GAMMA:	Normal	Normal
PRN Speed:	Normal	Normal
Load user:	1	1
System Setup:		
LCD. Center:	7	7
Baud Rate:	4800	4800
Beep:	ON	ON
IRE.:	100	100
Save User:	1	1

Table 11-5 UP-21MD Printer Settings (Continued)

	HDI 4000 Default Settings[1]	
Menus and Parameters	**NTSC Settings**	**PAL Settings**
Function:		
Auto Live:	OFF	OFF
Immed. Cap.:	OFF	OFF
RM2 Func.:	C&Print	C&Print
Clear:	ALL	ALL
Color Balance:		
BAL X:	50	50
BAL Y:	50	50
BAL Step:	5	5
IN:		
INPUT SEL:		
Video:	N/A	N/A
S – Video:	N/A	N/A
RGB:		
Hue:	* * * * *	* * * * *
Color:	* * * * *	* * * * *
Gain:	0	0
Offset:	0	0
AGC:	ON	ON

Table 11-5 UP-21MD Printer Settings (Continued)

	HDI 4000 Default Settings[1]	
Menus and Parameters	**NTSC Settings**	**PAL Settings**
OUT:		
Display:	OFF	OFF
RBN Remain:	OFF	OFF
Source:	EE	EE
Sync on G:	ON	ON
Moni C–R:	0	0
Moni M–G:	0	0
Moni Y–B:	0	0

1. The NTSC/PAL switch on the rear of the printer is set to the video format designated on the COA.

Table 11-6 CP800 Main Menu Control Settings

Menus and Parameters	HDI 4000 Default Settings[1]
COLOR ADJ	
BRT	7 or User's preference
CONT	5 or User's preference
R-SUB	0
G-SUB	0
B-SUB	0
CENTER	PUSH
ANALOG ADJ	
BRT	7
CONT	5
R-SUB	0
B-SUB	0
CENTER	PUSH
INPUT	
	RGB
ADDITIONAL	
MULTI	OFF
BUZZER	TONE 1

Table 11-6 CP800 Main Menu Control Settings (Continued)

Menus and Parameters	HDI 4000 Default Settings[1]
PRINT	
MODE	S
GRAD	NORMAL
GAMMA ADJ	N/A
APT	NORMAL
COM	OFF
MIRROR	OFF
COMMENT	[>]
SIZE/TIMING	
H-POSI	-2
H-START	FRONT
SIZE	USER
SAVE PRG	-6

1. The RGB and SYNC switches on the printer rear panel are to be set to 75 OHM.

Table 11-7 CP800 Printer Service Menu Parameter Settings

Menus and Parameters	HDI 4000 Default Settings
KEY SET	
KEY LOCK	OFF
MEM & PRN	ON
MEM & STOP	OFF
MEM & MONI	OFF
PRN & CLR	OFF
CLEAR KEY	PAGE
KEEP MONI	OFF
SIGNAL SET1	
FIELD	NORMAL
AFC	OFF
SYNC	EXT
R-SUB	0
B-SUB	0
SIGNAL SET2	N/A

Table 11-7 CP800 Printer Service Menu Parameter Settings (Continued)

Menus and Parameters	HDI 4000 Default Settings
PRINT SET	
DIR	NORMAL
MARGIN CUT	OFF
AUTO CUT	ON
OP MODE	3P
SYSTEM SET	
PAGE INC	ON
LIVE SELECT	DIGITAL
CONVERT	ON
REMAINING	OFF
REMOTE SET	N/A
PREVIOUS ERROR	N/A

Table 11-8 AG-MD835 VCR Switch Settings

Switch	Settings
AUDIO OUT	MIX
	NORM
INPUT	S-VIDEO
S-VHS	AUTO
MENU	SET
MODE LOCK	OFF
RS-232 Adapter DIP switch	1 = OFF 2 through 4 = ON

Table 11-9 AG-MD835 VCR Configuration Settings

Menu	Parameters and Sub-parameters	Display Reading	Possible Settings	HDI 4000 Settings
1	VISS	1001:00	Off	Off
1a	Tape Select	1001:01	Record	
1b	Auto Back	1001:02 1002:00 1002:01 1003:00 1003:01	Record/ Pause T-120 (NTSC) E-180 (PAL) Off On	T-120 (NTSC) On
1c	Tape In Mode	1004:00 1004:01	Stop Rewind	Stop
1d	Tape End Mode	1005:00 1005:01	Stop Rewind	Stop
1e	REC Tape End	1006:00 1006:01	Stop Eject	Stop
1f	STBY Off Time	1007:00 1007:01 1007:02	0 min. 5 min. 30 min.	5 min.
2	Hi-Fi REC	1008:00	Off	On

Table 11-9 AG-MD835 VCR Configuration Settings (Continued)

Menu	Parameters and Sub-parameters	Display Reading	Possible Settings	HDI 4000 Settings
2a	Audio Dub	1008:01	On	
		1009:00	CH1, CH 2	CH1
		1009:01	CH1	
		1009:02	CH 2	
2b	Edit	1010:00	Off	Off
		1010:01	On	
2c	YC Filter	1011:00	NTSC only	NTSC
3	Notch	1011:01	PAL only	N/A
	Hour Meter	XX XX H (where xx xx is the number of hours the VCR has had power applied)	N/A	
4	Bit Length	3001:00	7-Bit	
		3001:01	8-Bit	8-Bit
4a	Stop Bit	3002:00	Stop-1	
		3002:01	Stop-2	Stop-2

Table 11-9 AG-MD835 VCR Configuration Settings (Continued)

Menu	Parameters and Sub-parameters	Display Reading	Possible Settings	HDI 4000 Settings
4b	Parity	3003:00	Odd	
		3003:01	Even	
		3003:02	None	None
4c	Baud Rate	3004:00	1200	
		3004:01	2400	
		3004:02	4800	
		3004:03	9600	9600

12 Change History

Introduction

This section summarizes the software and hardware changes associated with specific software releases. Unless noted under “Hardware Changes,” hardware changes do not always accompany a software release. See Table 13-1 for part numbers of the released software versions. Compatibility information is addressed in the *HDI 4000 Master Compatibility Matrix*. Any hardware part number additions or changes that accompany these releases are incorporated into Section 14, “Parts”.

Initial System Release (v1.00.01.030)

Philips Ultrasound released the HDI 4000 Ultrasound System for distribution in June 2002. The software version at initial release was 1.00.01.030.

System Baseline Software Release (v1.00.02.035)

In July 2002, Philips Ultrasound released new baseline software for the HDI 4000 ultrasound system. The initial software (1.00.01.30) and the pre-release software versions (1.00.00.013 and 1.00.00.016) were be replaced by software version 1.00.02.035. This release corrected the software error in vascular measurement described in “Changes and Problems Corrected” on page 223.

Features Supported

All of the features supported in the previous versions of the software are supported in this version of the software.

Changes and Problems Corrected

The 1.00.02.035 software corrected the the following problems:

- The averaged result is not displayed. Only the measurement associated with the cursor on the screen is shown.
- The final report displays the **-** (negative sign) if the measured value is negative but uses the absolute value in calculating the average. For example, 10.0 cm/s and -5.0 cm/s gives an average result of 7.5 cm/s, not 2.5 cm/s.

Hardware Description

There were no hardware changes associated with this release.

System Software Release (v1.00.04.049)

Philips Ultrasound released new software for production HDI 4000 ultrasound systems in September 2002. The previous production software version (1.00.02.35) was replaced by software version 1.00.04.049. This release was to support new production system hardware that the previous software versions did not.

Features Supported

All of the features supported in the previous versions of the software are supported in this version of the software. No new features were released with this version.

Changes and Problems Corrected

See “Hardware Description” on page 224.

Hardware Description

Various component changes on certain system PCBs were cause for new part numbers even though form, fit, and basic function did not change (for functional notes, refer to the hardware comments on the *HDI 4000 Master Compatibility Matrix*). Also, new systems started shipping with faster CD-RW drives.

This software release was backward-compatible with all of the previous system hardware. At this release, the new Beamformer and Digital Scan Converter PCBs and the new CD-RW drive required version 1.00.04.049 software.

System Baseline Software Release (v1.00.05.053)

Philips Ultrasound released new baseline software and hardware for the HDI 4000 Ultrasound System in October 2002. Software version 1.00.05.053 replaced all previous software versions, including the previous production software (1.00.04.049) and the previous baseline software (1.00.02.035). In addition to the baseline software, systems also had an internal cable change, new scanhead (probe) holders, and new system ID labels. This release fixed the problems described in “Changes and Problems Corrected” on page 225.

Features Supported

All of the features supported in the previous versions of the software are supported in this version of the software. No new features were released with this version.

Changes and Problems Corrected

This release corrected the following two problems (reported in Operating Notes 4xx7-0037-04 Rev A):

High Q Trace Results

When the High Q® trace is configured to trace spectral Doppler both above and below the baseline, the trace results returned for the **Peak Systolic Velocity**, **PI**, and **S/D** ratios are incorrect. For exam types using High Q Doppler tracing, configure the system setups to trace only above or below the baseline; this ensures the correct results are displayed. Do not use High Q tracing for tri-phasic flow states where the spectral display is both above and below the baseline. Always measure using the **DIST** control or **CALC** control to obtain proper results.

3D8-5v Scanhead Image

The 3D volume image rendered with the 3D8-5v is displayed as a mirror image of the actual acquired data. To view the 3D volume in the correct orientation, the user must invert the image. For single-sweep acquisition, press the **Invert** blue menu key, and for Live 3D acquisition, press the **Orientation** blue menu key, until the proper image is presented.

Hardware Description

The existing Motor Controller PCB-to-Backplane ribbon cable (Figure 11-1) was replaced by a similar cable that has an eight-lead twist, positioned in the cable adjacent to the plug that connects to the Backplane.

New, re-designed scanhead (probe) holders provide support for the extra weight and dimensions of the 3D scanheads. Also, new screws hold the rubber part of the new scanhead holder to the new scanhead holder bracket. This assembly is secured to the lower control panel with the screws from the original scanhead holders.

“HDI 4000” system ID labels were available for the first time, which where applied to each side of the system.

System Software Release (v1.01.00.063)

Philips Ultrasound released performance-improved software on production HDI 4000 Ultrasound Systems. Identified as the program phase 1.5 release, key features and capabilities are summarized in “Features Supported.” The 1.5 software was not a baseline release.

Features Supported

This list summarizes the features added or changed in this release, which also supports all features supported in the previous software version. The *HDI 4000 Ultrasound System User Information Update* (P/N 4xx5-0037-02) provides detailed information about each of the following:

- Image quality improvements
- Pulse Inversion Harmonic Imaging
- Contrast Specific Imaging
- Text feature changes
- Backup and export to CD-RW and CD-R
- DICOM device limits
- High Q® setups
- Display changes
- Carotid measurement setups
- Measurement results display after unfreeze
- Calculations **Measure** menus
- OB tables
- OB and Gynecology reports

- **USER** controls
- Searching for a patient file
- Worklist

The service diagnostics portion of the baseline and previous HDI 4000 systems also changed in the 1.5 pre-release (1.01.00.059) and final release (1.01.00.063) software. Software modifications separated the baseline and previous on-board/remote diagnostics feature into two features that can be independently enabled and disabled either long-term or for shorter intervals with time-sensitive passwords.

NOTE “On-board” diagnostics (**Diagnostics**) are accessed from the system control panel, and “remote” diagnostics (**Remote Service**) are accessed via direct connection of a PC to the system serial port or a PC teleconnection to the system through a USB modem.

These diagnostics-related issues existed at this release:

- Remote Service Client software is needed to run the remote diagnostics. It was not formally released with this version of the system software.
- Remote diagnostics via modem was not functional at this release.
- With this release, when the on-board diagnostics are enabled, no password shield prevents access to the on-board diagnostics; the customer has access.
- Diagnostics passwords from software level 1.00.05.053 or lower will not enable the Diagnostics or Remote Service features on systems with 1.01.00.059 or 1.01.00.063 software. Each diagnostic feature requires a new, custom password. Two types of password exist: One allows 24-hour use, and the other allows long-term use.

- Certain diagnostic tests produce results that you should not rely on. Until further notice, ignore the results of the tests in Table 12-1.

Table 12-1 Diagnostics Tests to Ignore

PCB	Tests
Beamformer	Data path test: BF AD to BF IC
	BF channel check
	BF summing chain test
	BF real time operation test
Digitial Signal Processor	MID Internal Memory read/write test
	Data path test: Clutter to FFT
	Data path test: Clutter to AUDIO
	Data path test: MID to FMB
	Data path test: MID to FMC
	Data path test: MID to FMM
	Data path test: SSRAM(BW) to FMB
	Data path test: SSRAM(CD) to FMC
	Data path test: FFT to LM(BW)
	Data path test: PDSP to LM(CD)
	Data path test: 3D data path

Table 12-1 Diagnostics Tests to Ignore

PCB	Tests
Video Manager	VM SGRAM(Image grabber) read/write test
	Data path test: BW FMB to Image Grabber
	Data path test: CD FMC to Image Grabber
	Data path test: FMM to Image grabber
	Data path test: FMCM to Image grabber

Hardware Description

There was no new hardware released with this version software, however, the software required the Motor Controller-to-Backplane ribbon-cable (Figure 11-1) change from 2975-0235-01 to 2975-0235-02.

System Release (No New Software)

The HDI 4000 ultrasound system was changed to a Philips color scheme (Figure 1-4) and started shipping (with version 1.01.00.063 software) in either December 2002 or January 2003. The system parts changed to Philips colors are identified in “Hardware Description” on page 230. These new systems were delivered with a newer motor controller cable (2975-0235-03) (Figure 11-1) that has a toroid added to fix a minor Doppler noise band issue.

Features Supported

See “Features Supported” on page 226.

Hardware Description

The following hardware (Table 12-2) was changed to the Philips colors with this release.

NOTE Do not mix ATL and Philips system colors. Order replacement hardware like-for-like (Table 14-1).

Table 12-2 Parts with the Philips Colors

Air Filter, Bottom, Assy
Arm, Swivel, Monitor
Bolt, Special, Thumb
Bracket, Fender
Bumper, Rubber, Side
Cap, Arm, Monitor
Cap, Rubber, Back
Cap, Rubber, Front
Cap, Rubber, Top, Rear
Cap, Wheel, 9-inch
Caster Assy, 5-inch (Front caster assembly)
Cover, Bottom, Back
Cover, Bottom, Front
Cover, Door, Side

Table 12-2 Parts with the Philips Colors (Continued)

Cover, ECG, Power, Assy
Cover, Fender, Left
Cover, Fender, Right
Cover, Keyboard, Alpha, Bottom
Cover, Keyboard, Alpha, Top
Cover, Keyboard, Bottom Assy
Cover, Keyboard, Bottom
Cover, Keyboard, Top
Cover, Middle, Front
Cover, Side Panel, Left
Cover, Side Panel, Right
Cover, Top Assy
Cover, Upper Assy, Back
Handle Assy
Hanger, Cable
Keyboard Assy
Knob, Encoder
Knob, Gain
Knob, TGC

Table 12-2 Parts with the Philips Colors (Continued)

Monitor Bowl
Monitor, Totoku (bezel is different shape also)
Pad, Rubber, Top
Support, Printer
Support, VCR
Trackball Assy, 58mm

13 Configuration

Introduction

This section lists all of the released software version part numbers for the HDI 4000 system, identifies the primary system PCBs, and shows where these PCBs are located in the system. When applicable, additional PCB reference information is provided.

Compatibility Information

See the *HDI 4000 Master Compatibility Matrix* (P/N 9015-0743) for the core information you need to determine the compatibility of primary system PCBs and certain hardware assemblies with respect to the system software releases.

System Software

Software release levels and corresponding part numbers are listed in Table 13-1. See Section 12, “Change History” for a summarized history of the software and hardware changes associated with specific software releases.

Table 13-1 System Software CD Part Numbers

Released Software Version	Disk Part No.	Dash Number	Notes
1.00.01.030	8000-2304	01	System software initial release (this is a kit with 1.00.00.024 CD, and 1.030 patch CD to bring the system software to v1.00.01.030)
4704-0037-01	4252-0972	01	User Help software (English) and load utility software on one CD
1.00.02.035	4252-0989	01	Baseline release

Table 13-1 System Software CD Part Numbers (Continued)

Released Software Version	Disk Part No.	Dash Number	Notes
1.00.04.049	4252-0976	04	Production release
1.00.05.053	4252-0976	05	Baseline release
1.01.00.063	4252-0994	02	Production release

PCB Reference Information

The following conditions apply to the PCB reference information provided in this section:

- PCB illustrations are provided only as an aid to verifying physical integrity or matching the physical configuration of new PCBs.
- Configurable jumpers and switches on PCBs should not require configuration by field service representatives at installation. Not all configurable devices are shown.
- The positions of components and test points shown are relative locations only, not necessarily to scale. Not all components and test points are shown.
- Potentiometers on PCBs shall *not* be adjusted by field service representatives, unless an authorized procedure instructs otherwise. Not all potentiometers are shown.

Locating and Identifying Primary PCBs

Figure 13-2, Figure 13-3, and Figure 13-4 show the general location of the primary system PCBs, with references to the corresponding PCB illustration.

Figure 13-1 **Scanhead Select Module (Probe Select Assembly) Detail**

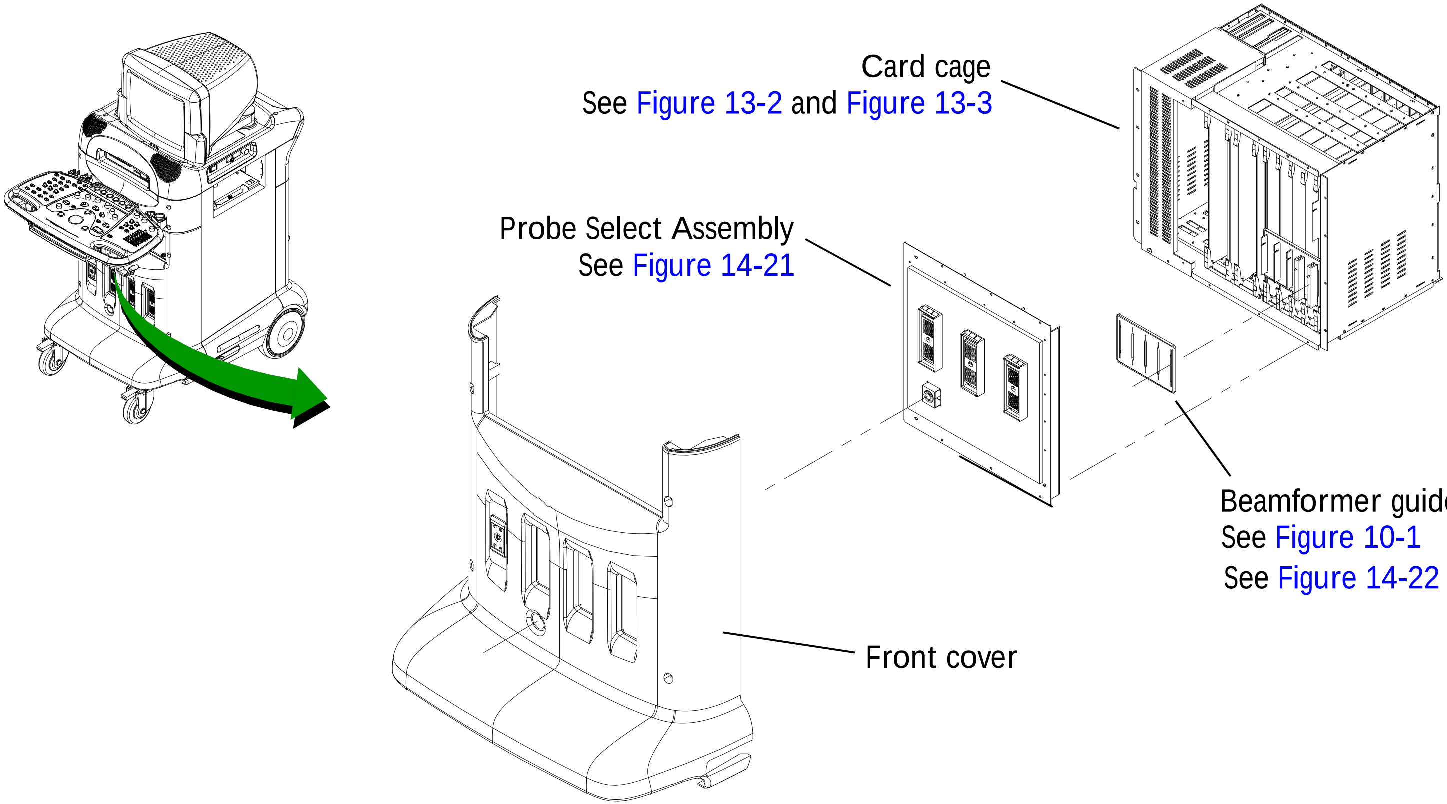
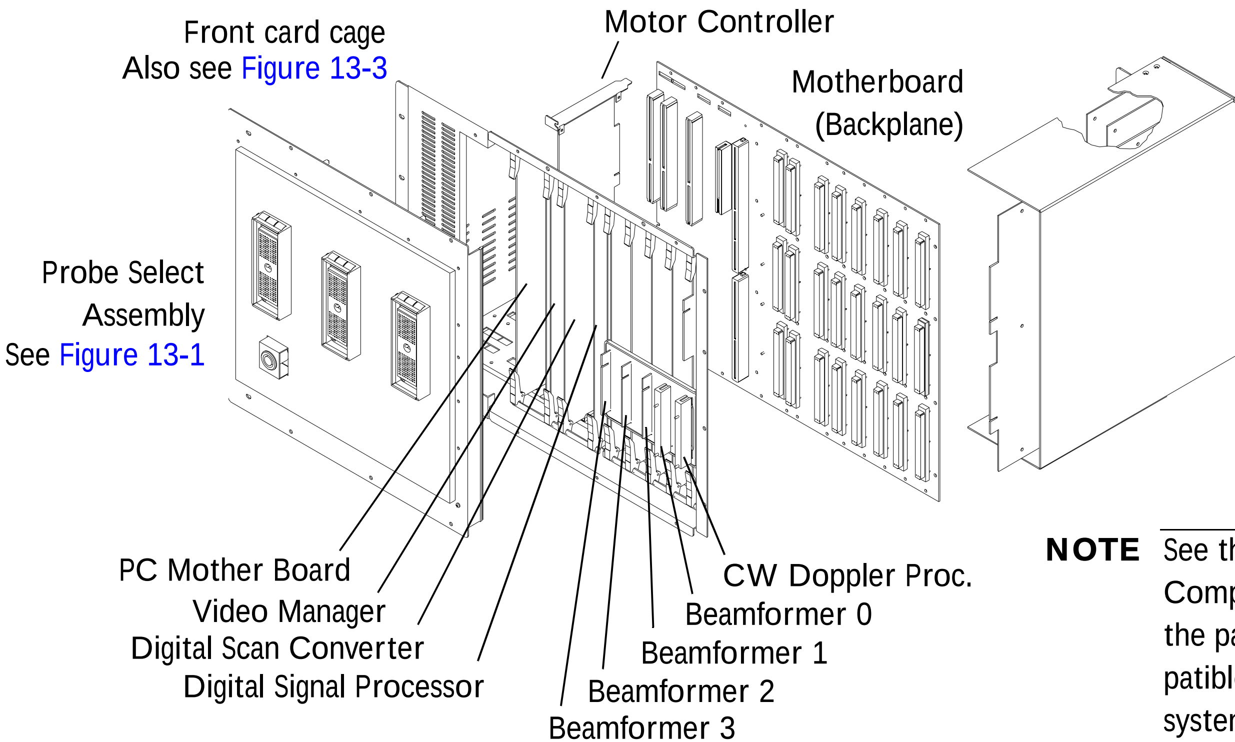


Figure 13-2 **Primary System PCB Names and Locations**



NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

Figure 13-3 **Front Card Cage PCB Detail**

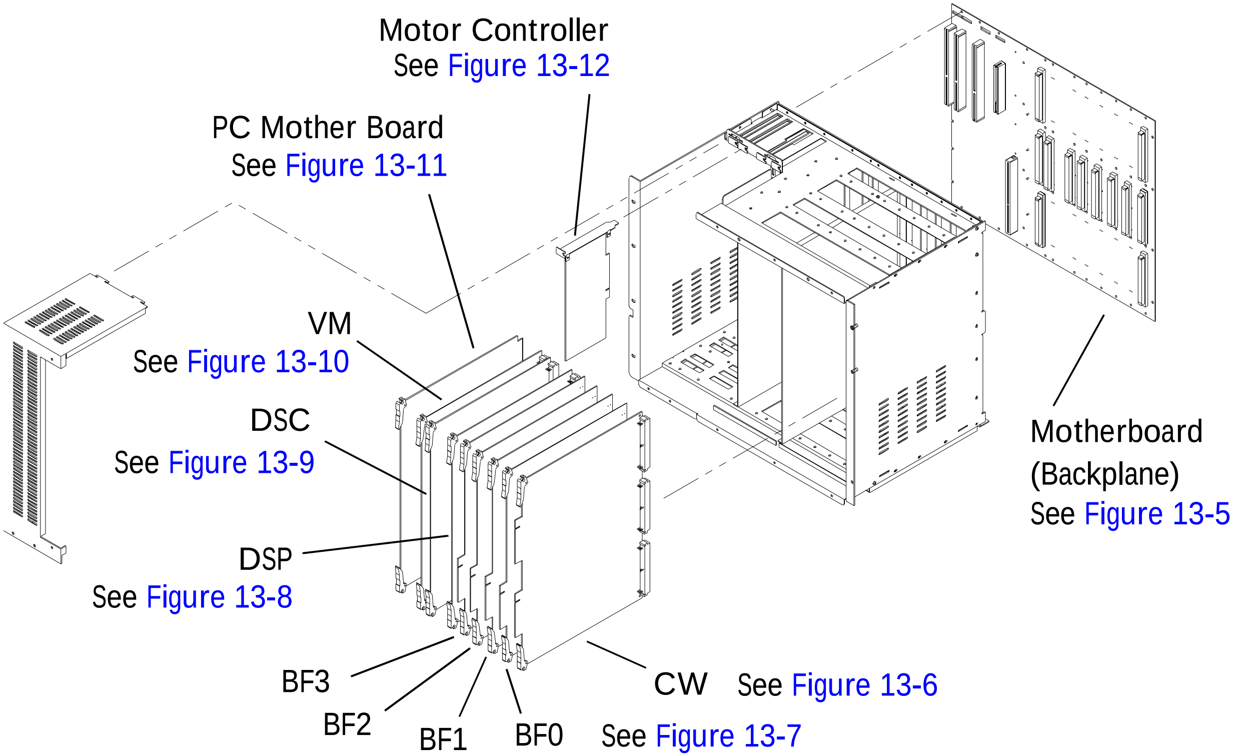
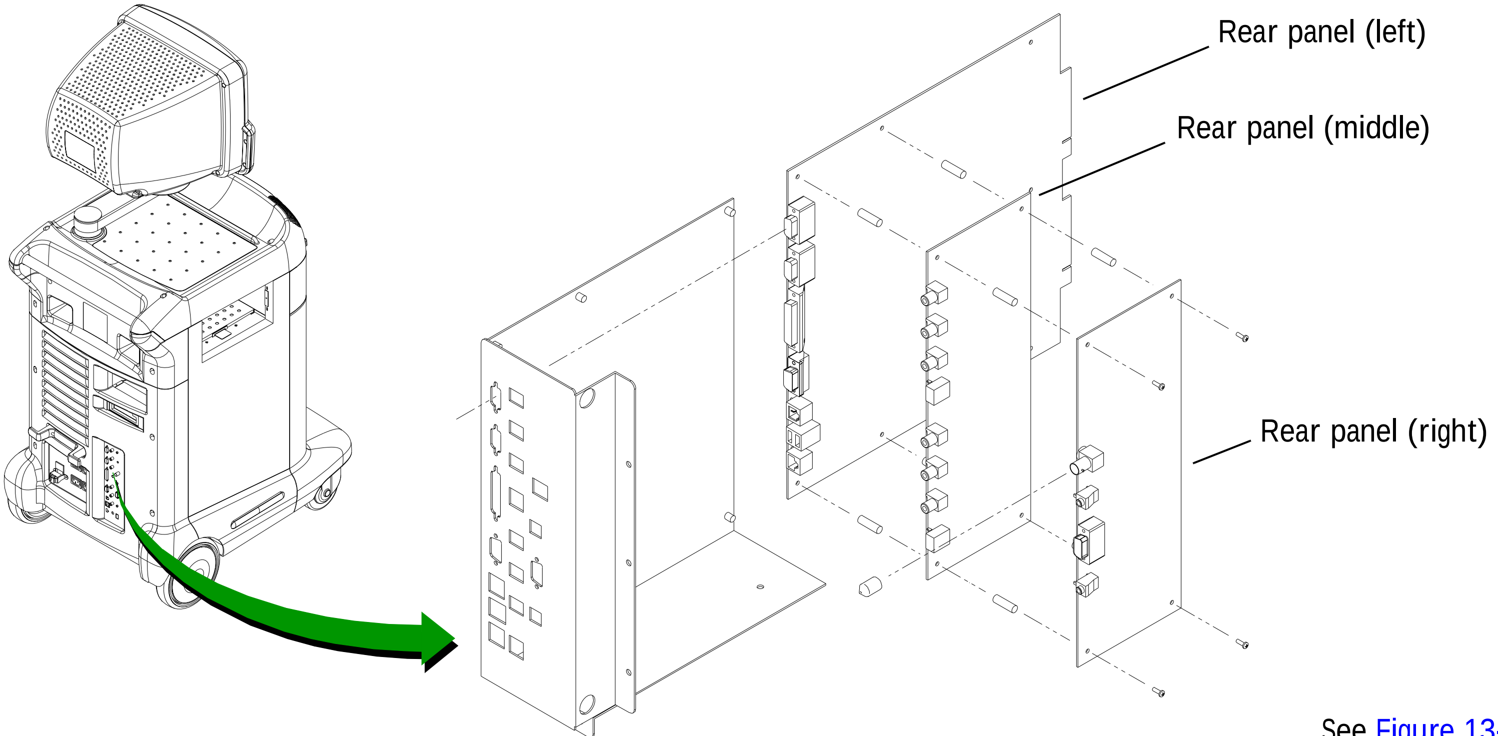


Figure 13-4 Rear I/O Connector Panel PCB Detail



See Figure 13-13

Figure 13-5 Motherboard (Backplane) PCB

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

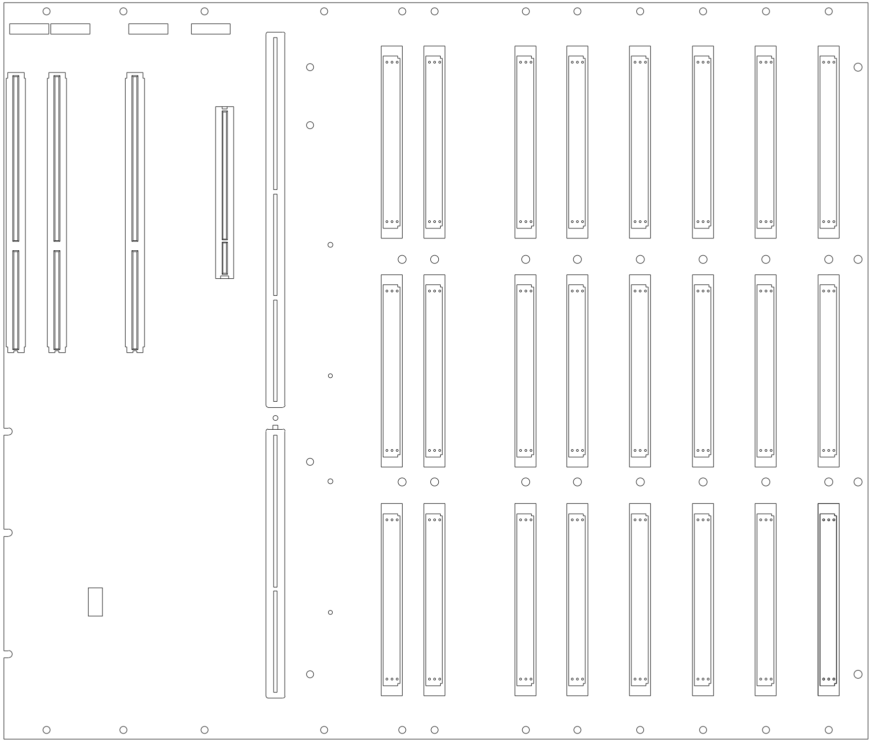


Figure 13-3

Figure 13-6 CW PCB

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

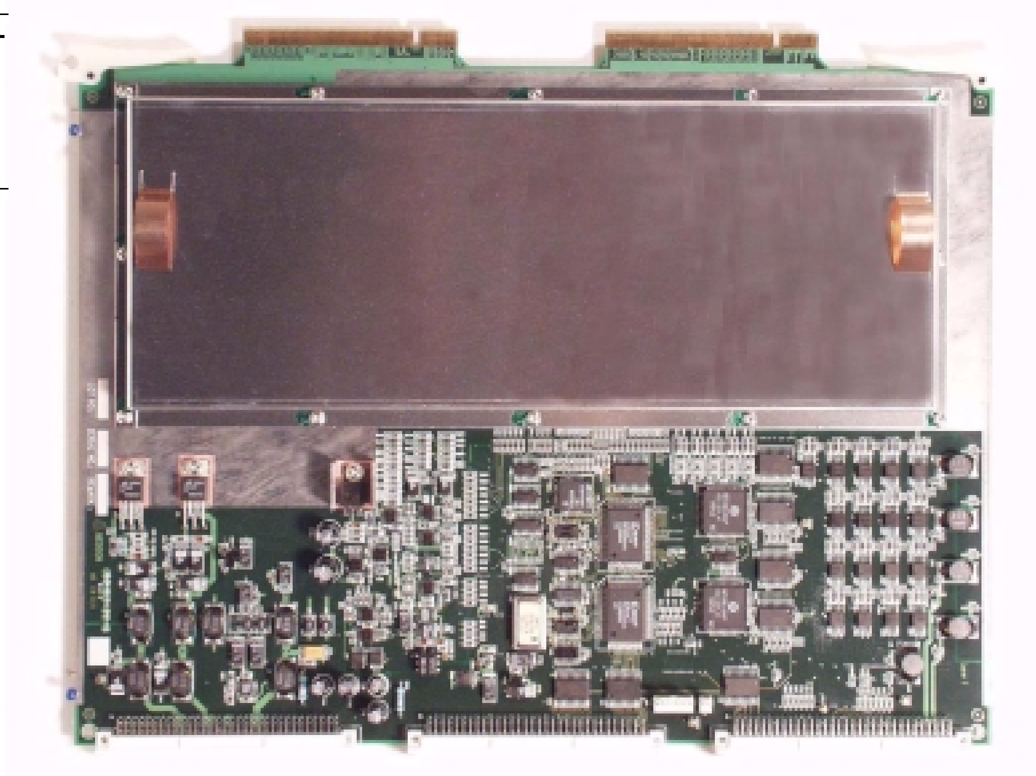


Figure 13-3

Figure 13-7 **Beamformer PCB (BF0, 1, 2, 3)**

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

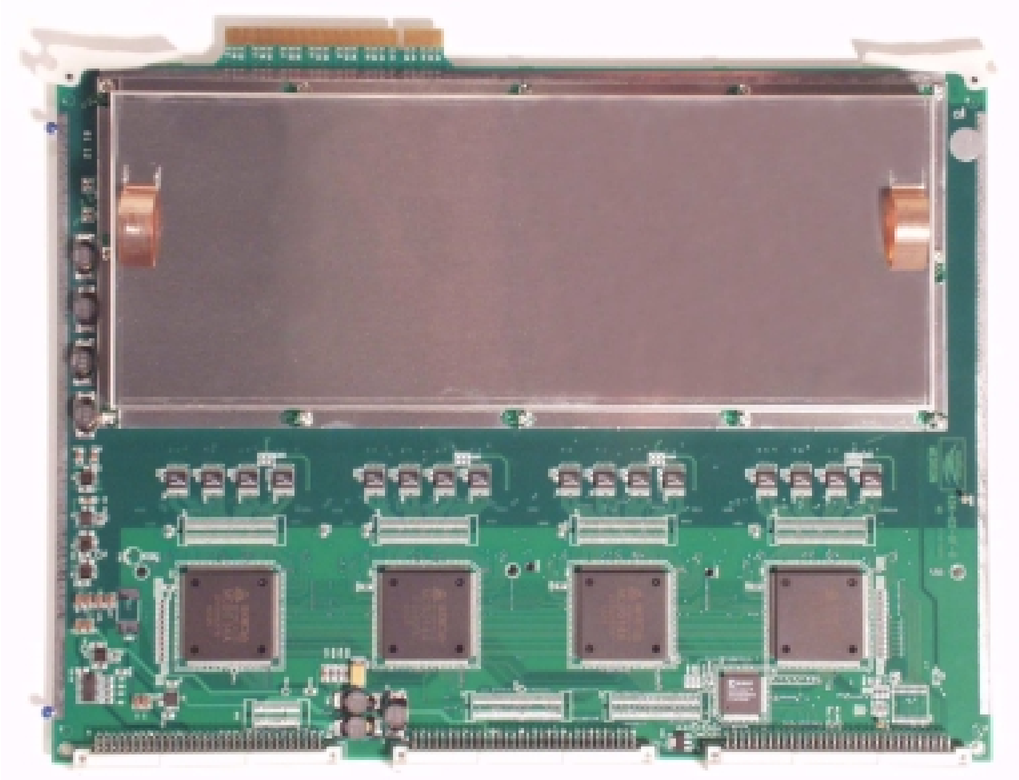


Figure 13-3

Figure 13-8 **Digital Signal Processor (DSP) PCB**

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

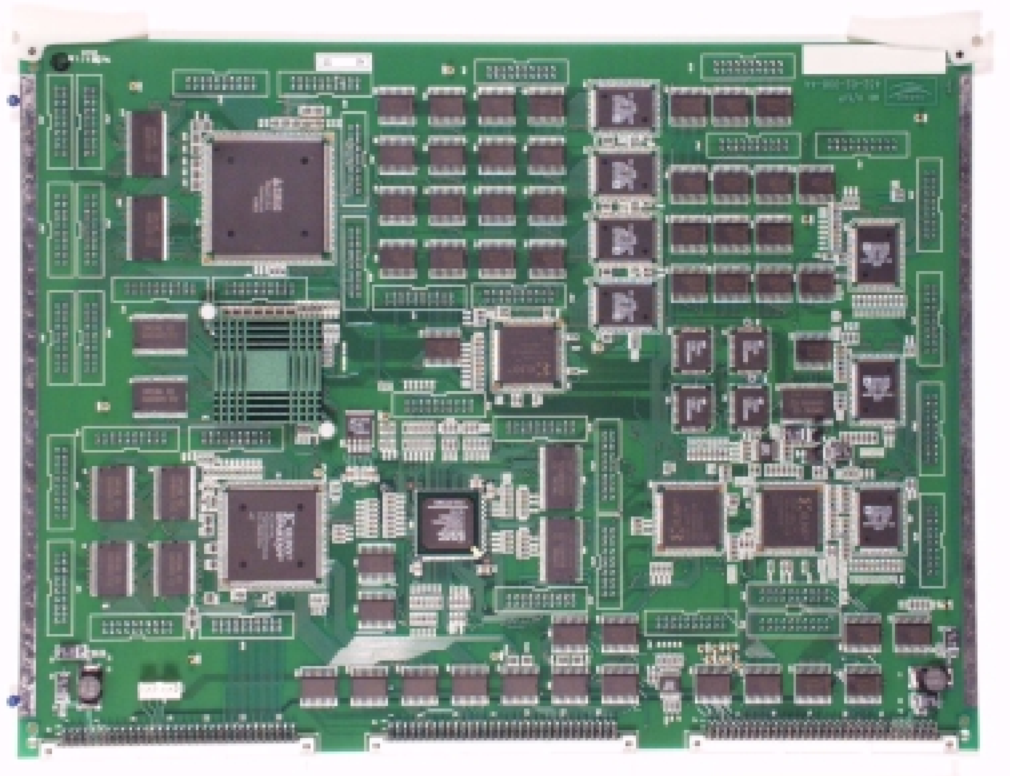


Figure 13-3

Figure 13-9 Digital Scan Converter (DSC) PCB

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

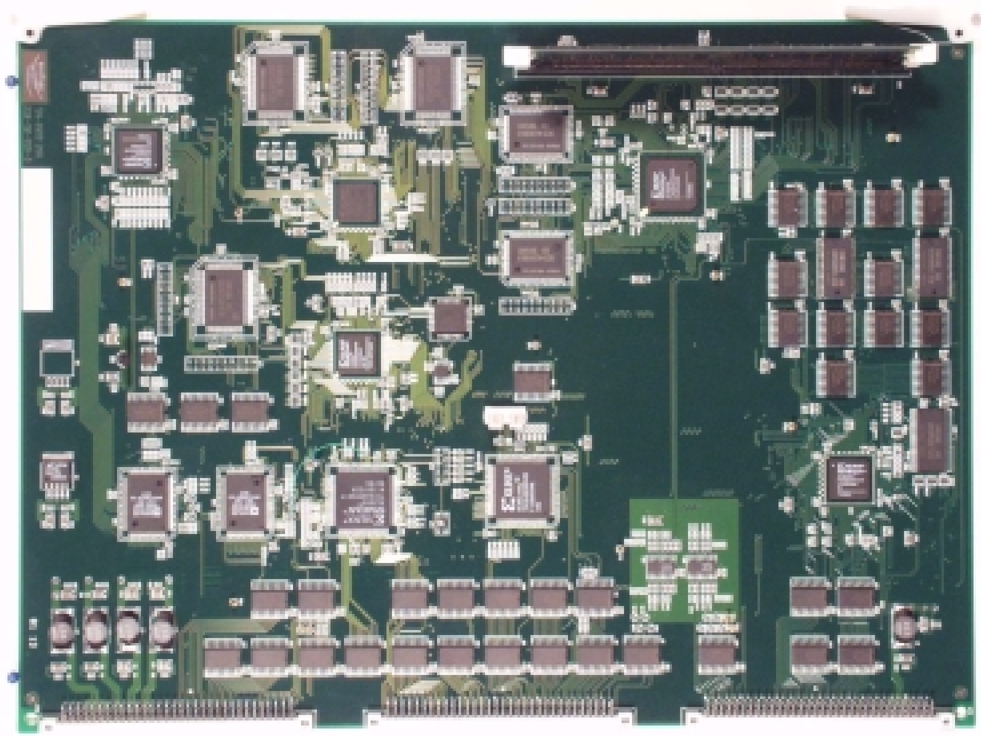


Figure 13-3

Figure 13-10 Video Manager (VM) PCB

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

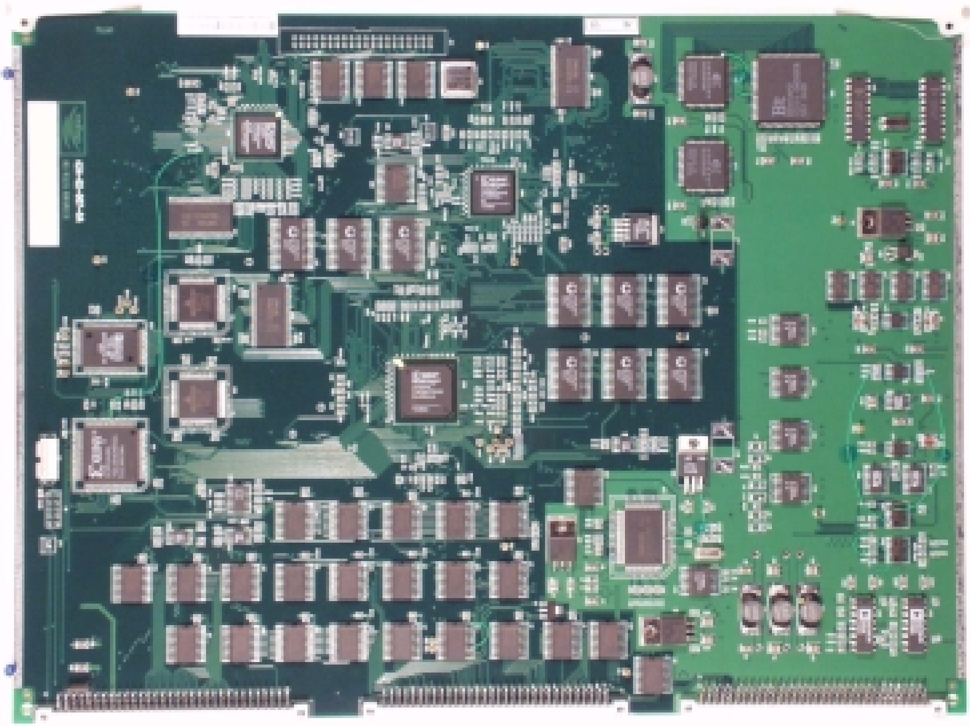


Figure 13-3

Figure 13-11 PC Mother Board

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

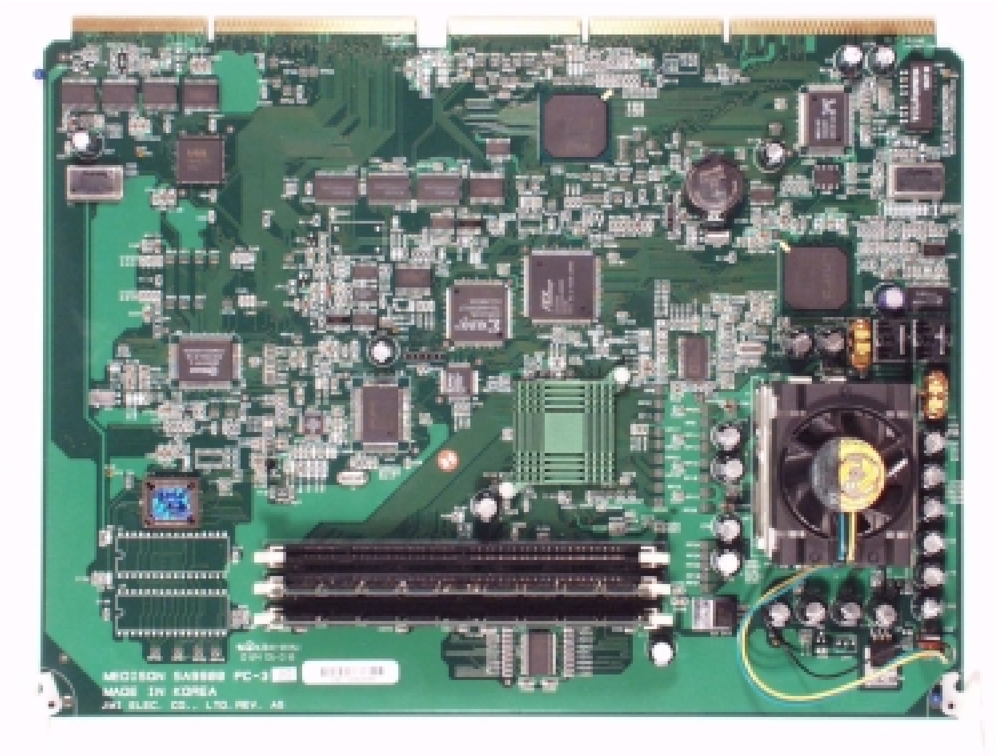


Figure 13-3

Figure 13-12 Motor Controller PCB

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

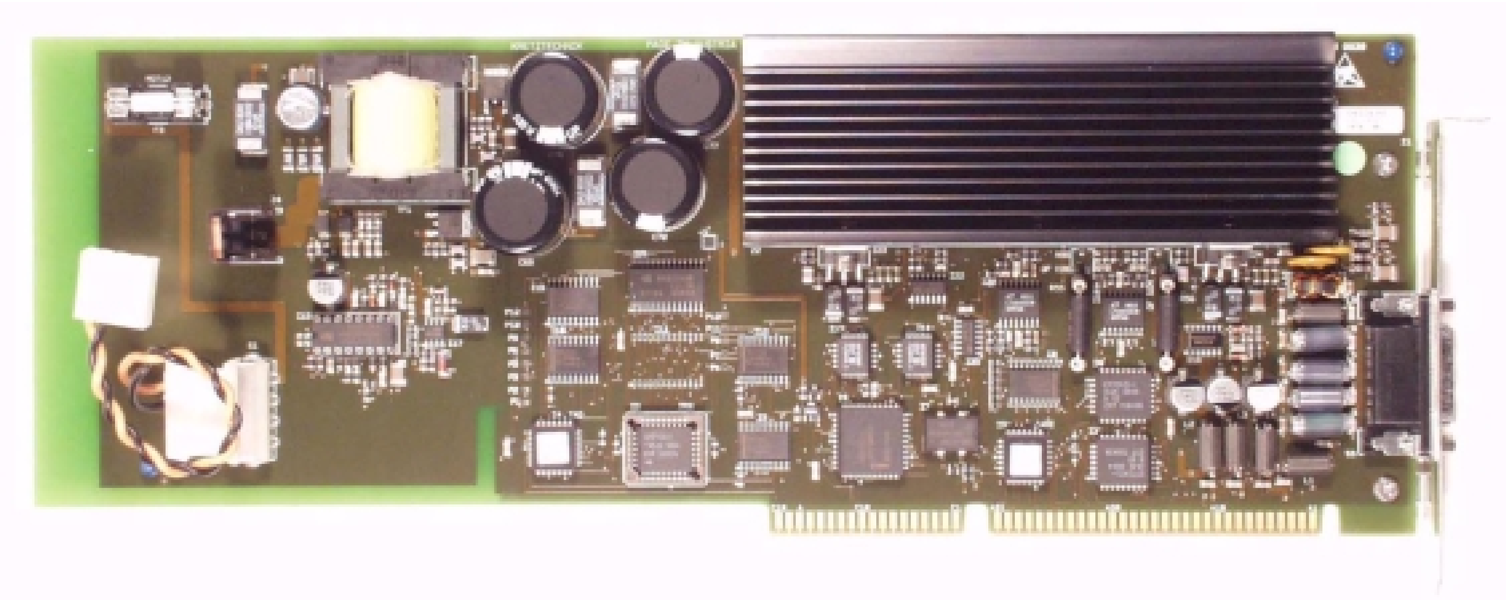
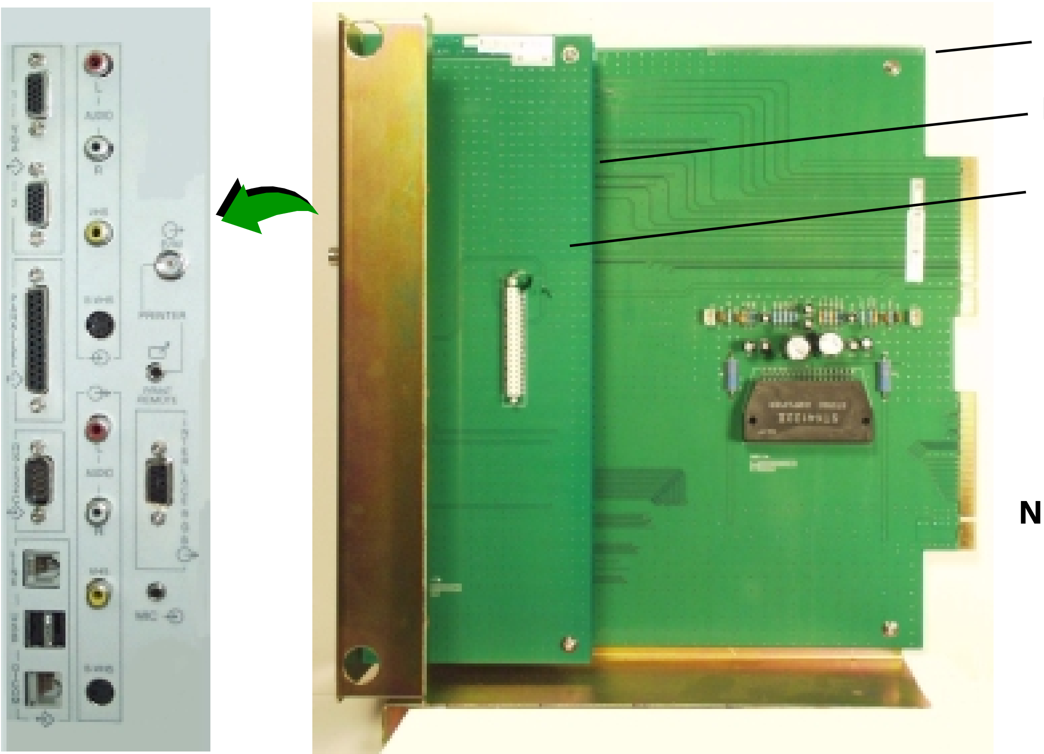


Figure 13-3

Figure 13-13 Rear Connector Panel PCBs

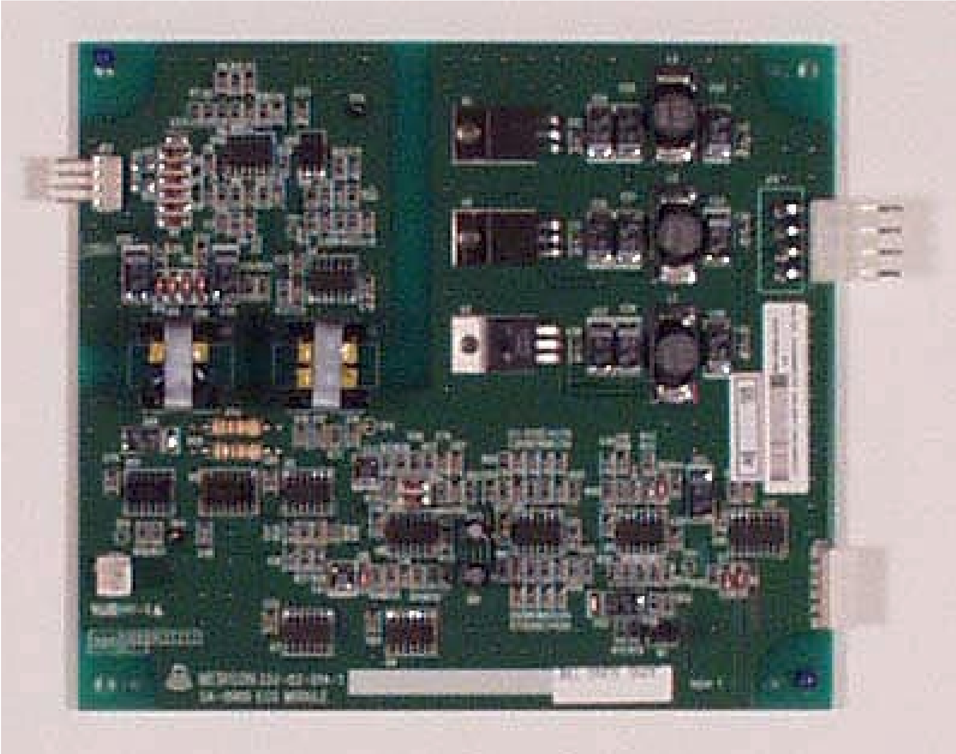


NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.

See Figure 13-4

Figure 13-14 ECG PCB

NOTE See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.



14 Parts

Introduction

This section lists parts information for the HDI 4000. For replacement part numbers that are dependent upon system features and software versions (primary PCBs and certain hardware assemblies), see the HDI 4000 Master Compatibility Matrix (P/N 9015-0743) .

Use the figures and parts table in this section to locate and identify system parts. Part numbers are shown on the illustrations as well as listed and described in the corresponding tables. Figures are keyed to the tables and the tables to the figures, as applicable. Use the part number, and description provided if needed, to order a part. Verify that the level of replacement for a given part is in accordance with current service philosophy before ordering the part.

Ordering Parts

Field Service Engineers

For parts ordering procedures, FSEs should refer to their Standard Operating Procedures.

Customers

Customers may order parts through an FSE or directly from the Philips Ultrasound Customer Service Order Processing Department. Customers ordering parts through an FSE will need to provide the following information:

- Shipping address
- Purchase order number of equipment
- Part numbers or sales order numbers
- Part descriptions and quantity needed

How to Find a Part Number

In this section, part numbers in the exploded view system illustrations (Figure 14-1 through Figure 14-35) point to the system parts. The part numbers in these figures link to the parts table (Table 14-1) containing descriptive information about the part. The parts table, arranged as follows, is alphabetized by description for your convenience. A separate table (Table 14-2) lists peripherals.

Using the Figures and Tables

➤ How to use the parts figures and tables

- Start your parts search by navigating to the “System Parts Locator Maps”, Figure 14-1 (System end views) or Figure 14-2 (System side views).
- If you need a part number, find the drawing of the part in the appropriate figure. The part number, or reference to where the part number appears, points to the drawing. If you need the part description, click on the blue part-number hypertext link to go to the corresponding item in the parts table.
- If you have the part number and want to look up the description in the table, use Acrobat Reader’s Find function to locate the part number. Then, if needed, you can click on the blue hypertext Figure link to go to the corresponding illustration.
- If you are using a printed version of this manual and need more than just the part number shown on the figure, the parts are alphabetized in the table by description, so you can look up the part by description.

Parts Table Definitions

Located On This column lists all of the figures on which the part is found.

Part Number This column lists the part number for an item. Use this number when ordering parts from Philips Ultrasound. If a table is referenced in this column, the part number is on that table. For example, the part numbers for signal cables are in Table 11-1.

Part Description The name of the item or part is listed here. Where appropriate, the description column also includes size, tolerance, type or model, and material data for the part. Table 14-1 is sorted alphabetically by items in this column.

Attaching parts must be ordered separately. They are not provided with the assembly, subassembly, or component being attached.

Notes/Reference Manufacturer's part numbers, sometimes alternate part numbers, special applications, and other information pertaining to a specific part are listed in the Notes/Reference column.

Figure Definitions

3500-0000-00

Part Number The part number for each part or subassembly shown in an illustration is a hypertext cross-reference linking to the parts/cable tables containing parts descriptions and additional information.

See Figure 14-x

See Figure "See Figure" is a hypertext cross-reference link to a detail (sub-assembly) figure. In the sub-assembly figure you will find either the part number, reference to another detail figure, or a reference to the table containing parts descriptions and additional information.

SYSTEM VIEW

System View Illustration Label The "SYSTEM VIEW" (System Parts Locator Map) Figure 14-1, contains links to "PARENT VIEW" illustrations.

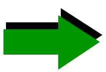
PARENT VIEW

Parent View Illustration Label "PARENT VIEW" indicates an illustration that provides links to additional parts breakdown, indicated with a "See Figure" reference.

System View Button The "System View" button is a hypertext cross-reference link to the "SYSTEM VIEW" (System Parts Locator Map). You can return to the "SYSTEM VIEW" (System Parts Locator Map) by clicking the "System View" button in the lower left corner of any figure in this section.

Parent View Button The "Parent View" button is a hypertext link to the parent-part or "PARENT VIEW" illustration.

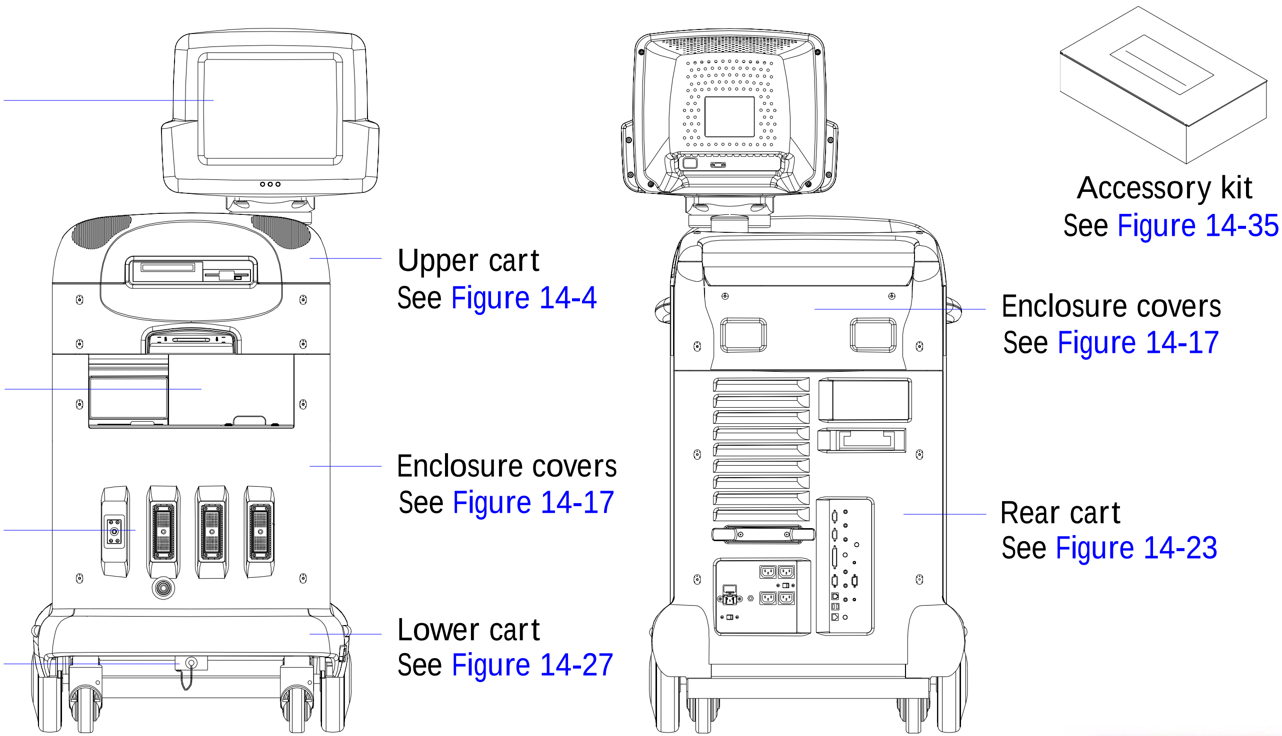
Parts List Button The "Parts List" button (located on the "System Parts Locator Map" only) is a hypertext cross-reference linking to the "Parts Table" containing parts descriptions and additional information. The "Parts List" can also be accessed by clicking on one of the blue part numbers in any of the figures in this section.



Green Arrow The green arrows found throughout the parts illustrations are used to indicate movement (assembly, disassembly, rotation), or point to a specific area (details, breakdowns).

Figure 14-1 **HDI 4000 System Parts Locator Map (Front and Rear Ends)**

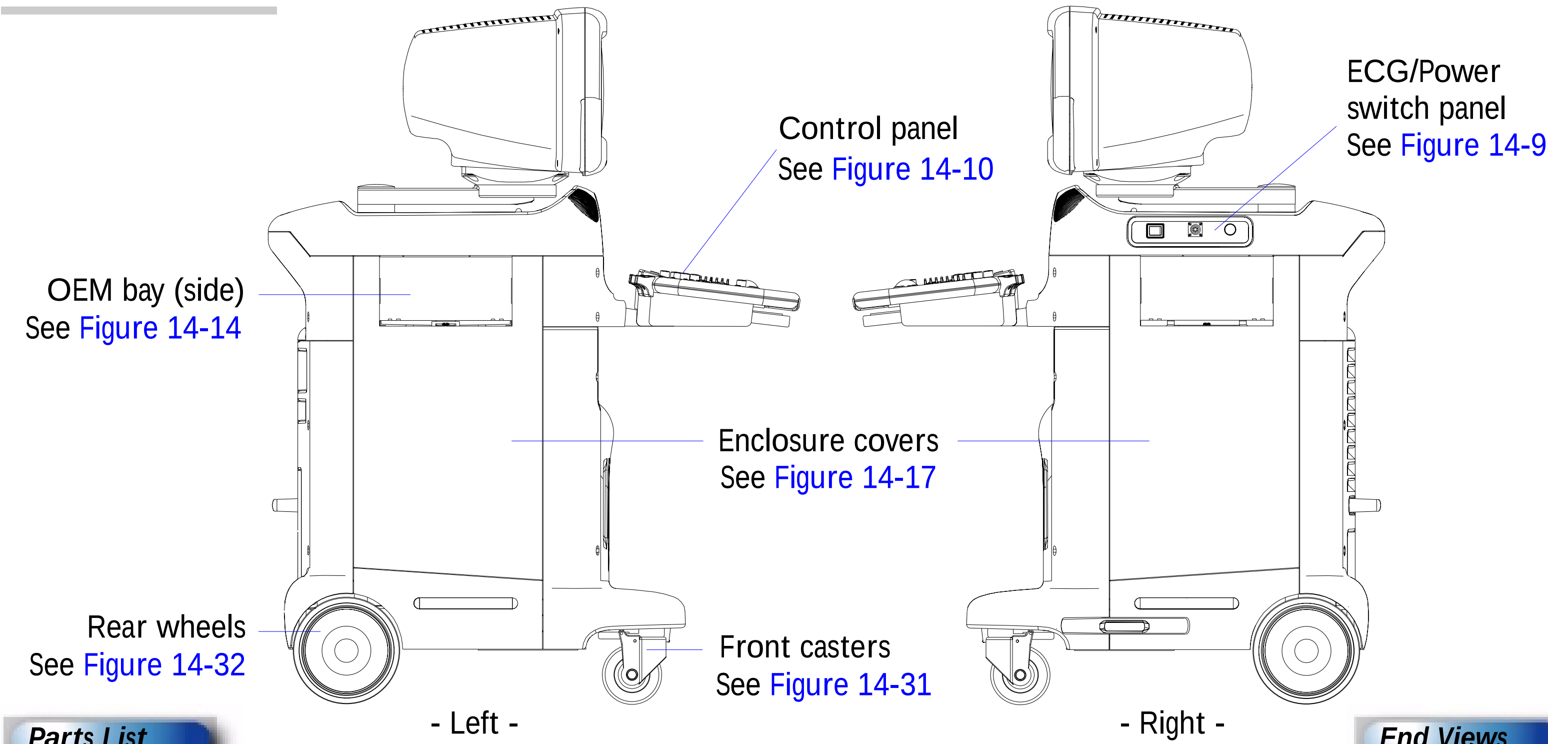
SYSTEM VIEW



Parts List
Side Views

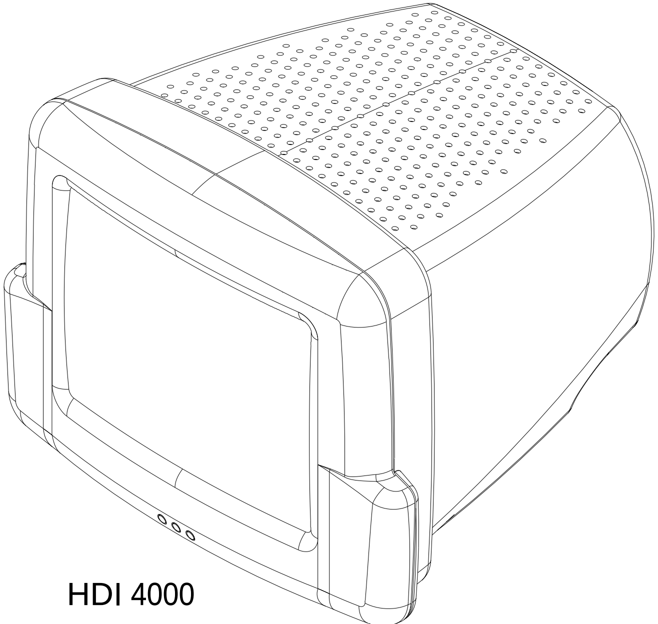
Figure 14-2 **HDI 4000 System Parts Locator Map (Left and Right Sides)**

SYSTEM VIEW

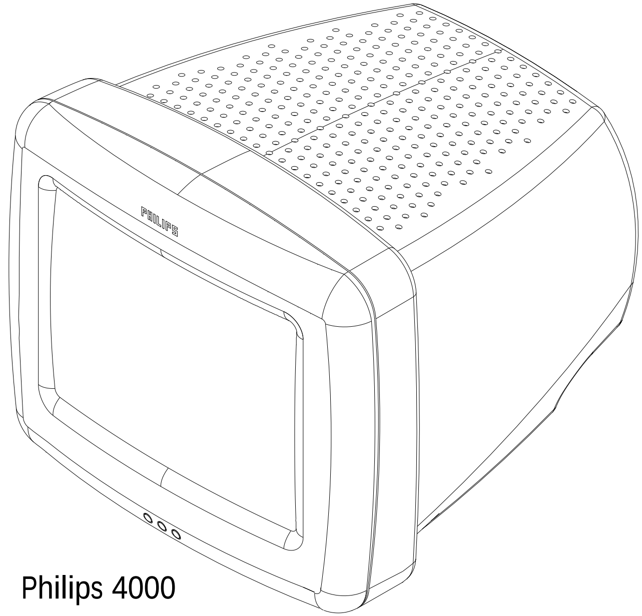


Parts List
End Views

Figure 14-3 **Video Monitor Assembly**



HDI 4000
Video monitor assembly
2175-0082-01

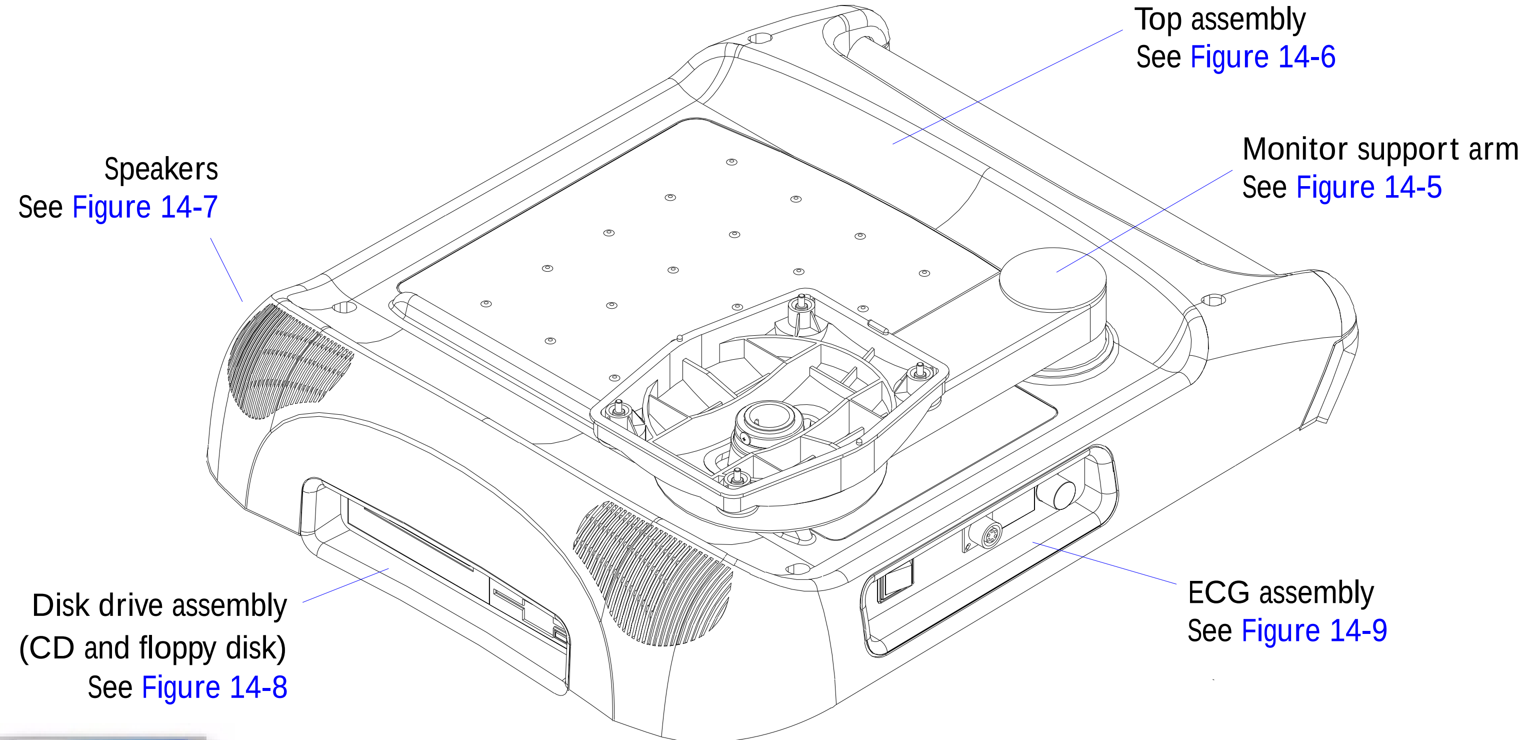


Philips 4000
Video monitor assembly
2175-0125-02

System

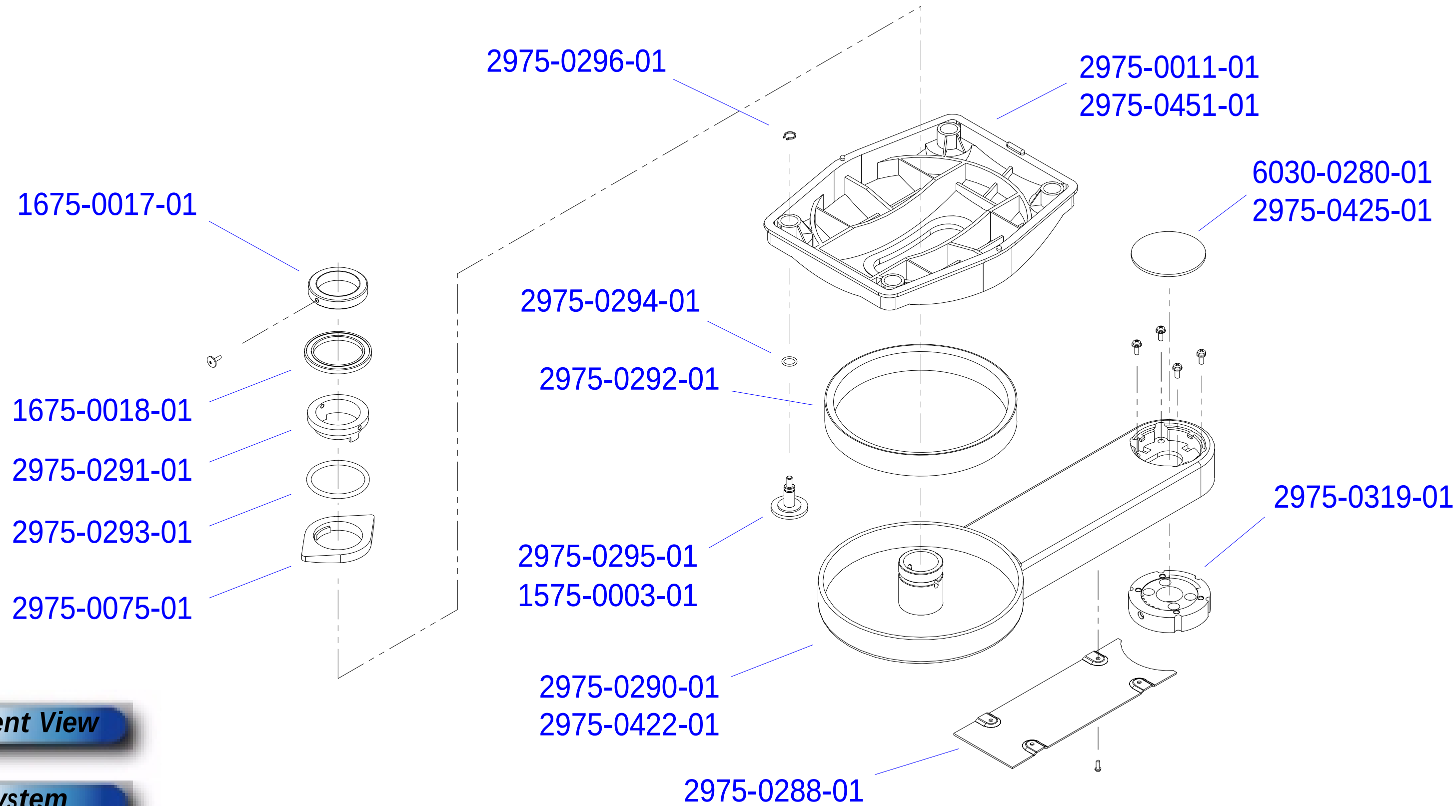
Figure 14-4 Upper Cart

PARENT VIEW



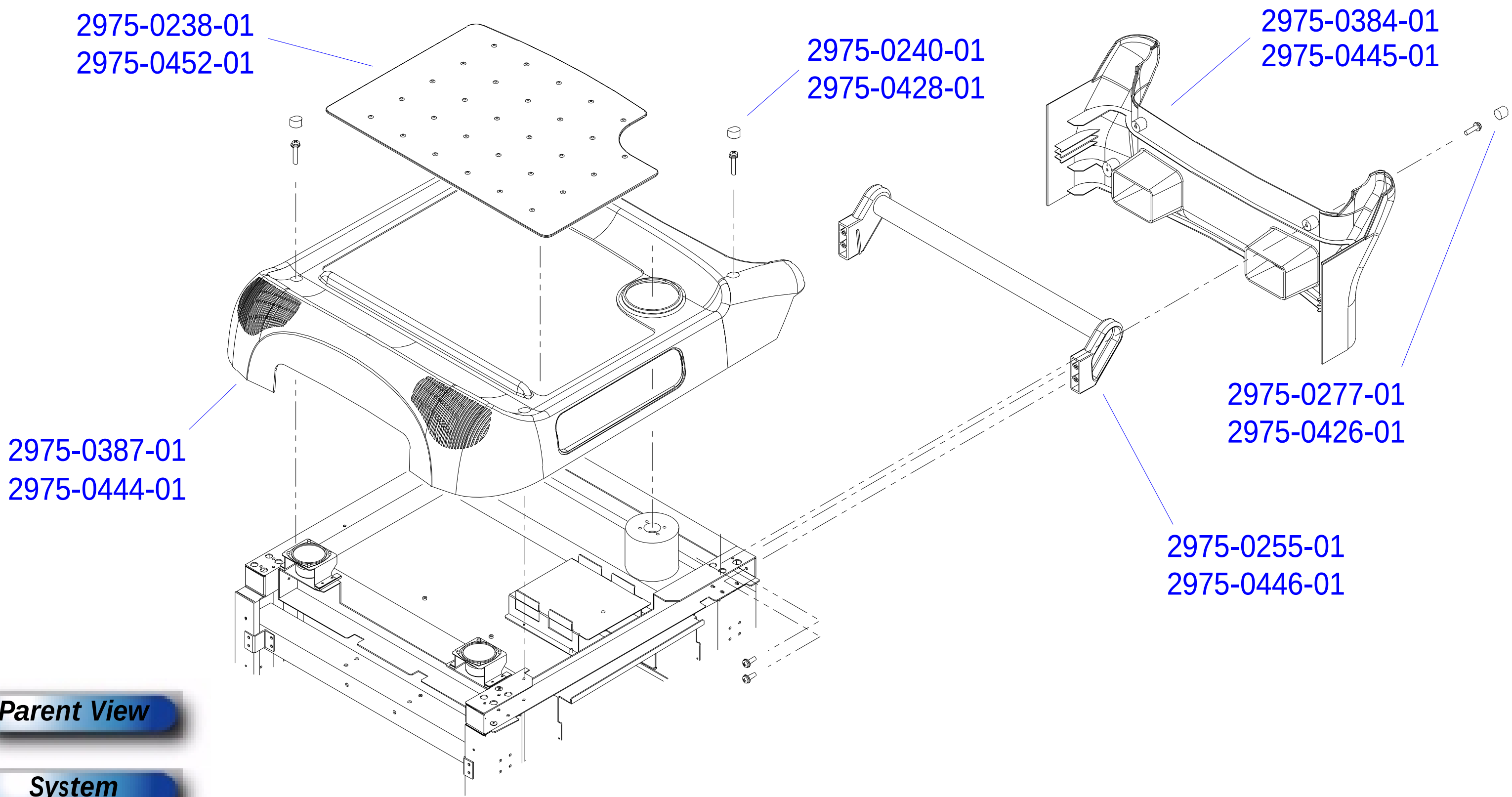
System

Figure 14-5 **Monitor Support Arm**



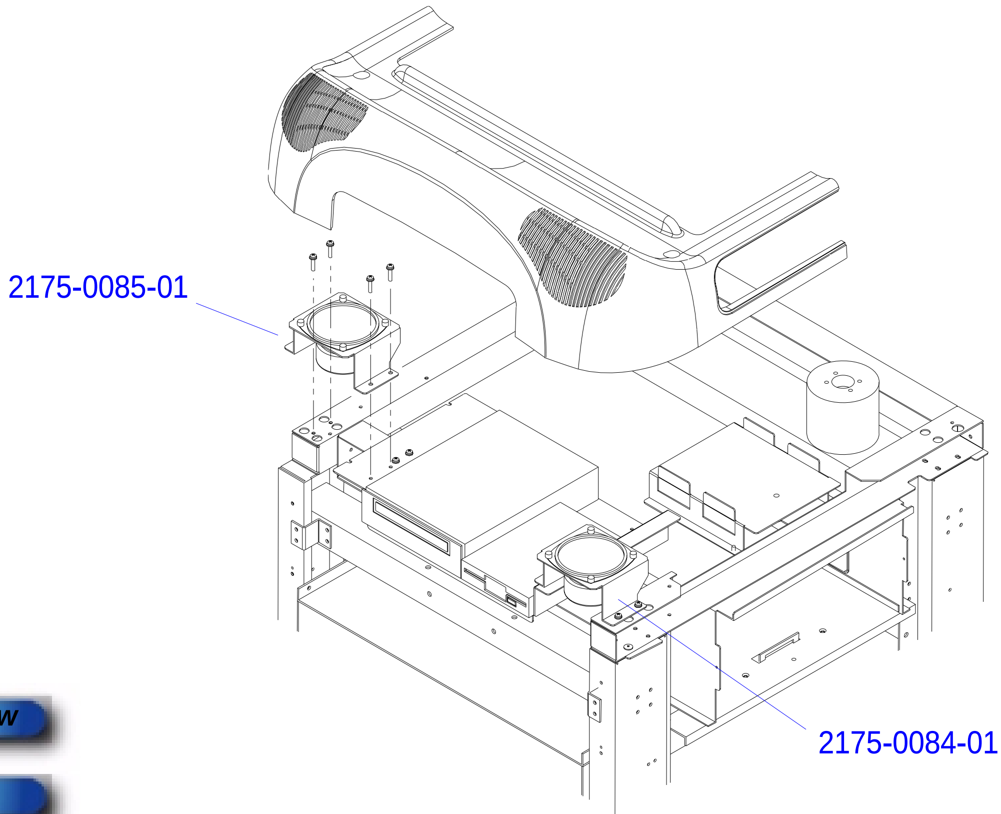
Parent View
System

Figure 14-6 **Top Assembly**



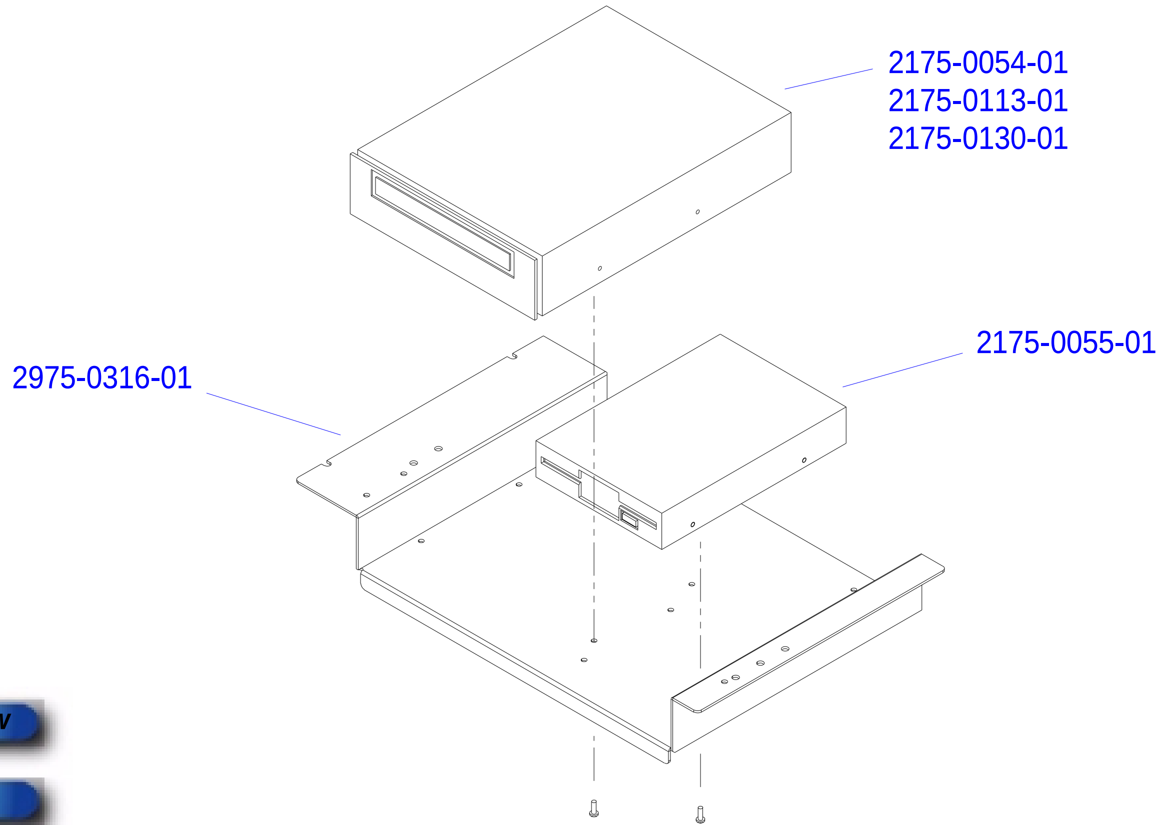
Parent View
System

Figure 14-7 **Speakers**



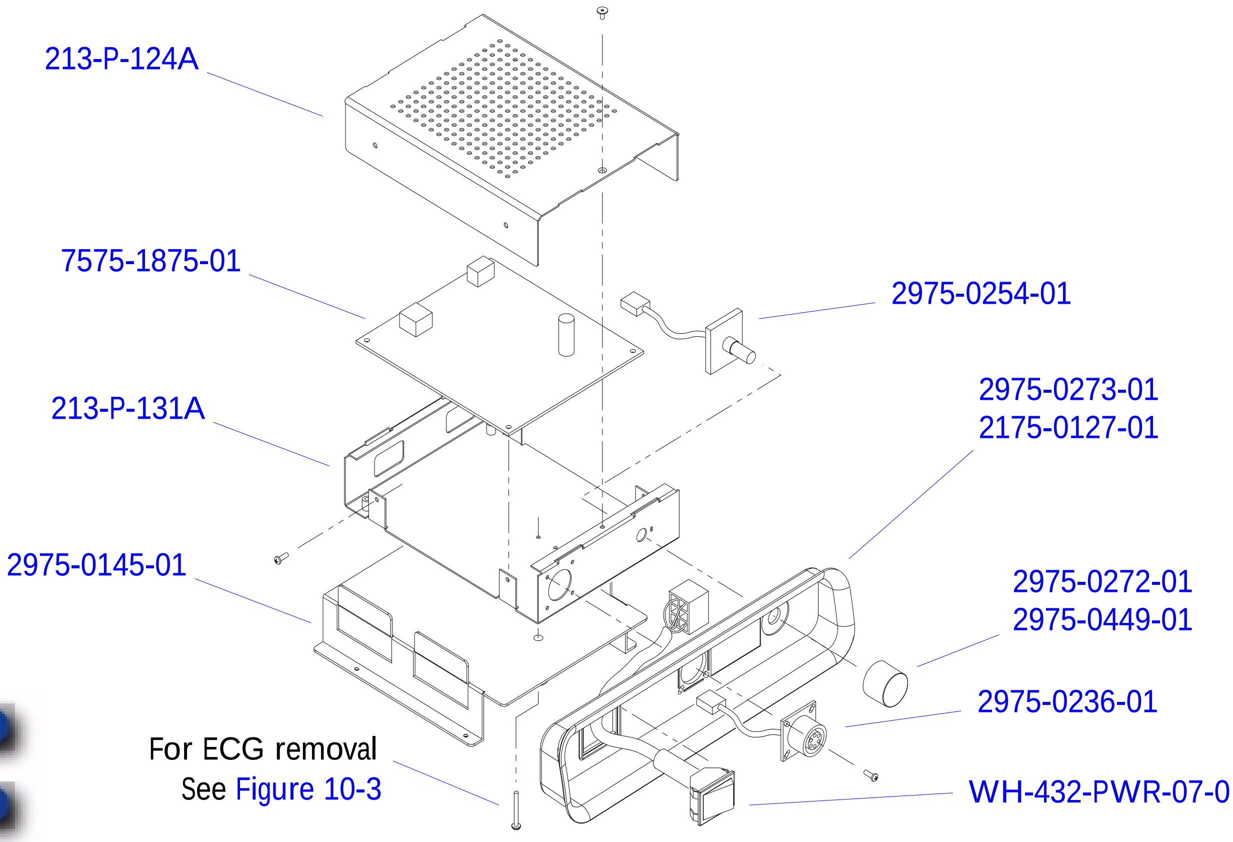
Parent View
System

Figure 14-8 Disk Drive Assemblies (CD and MO)



Parent View
System

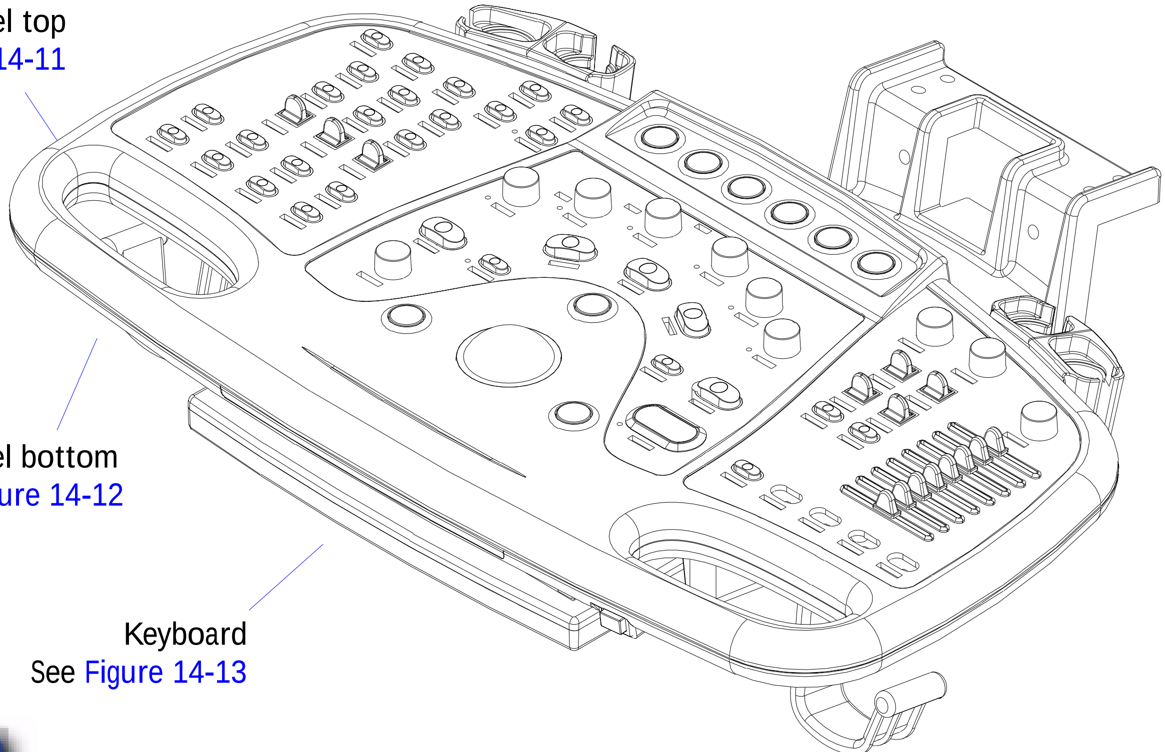
Figure 14-9 ECG Connector and System Power Switch Assembly



Parent View
System

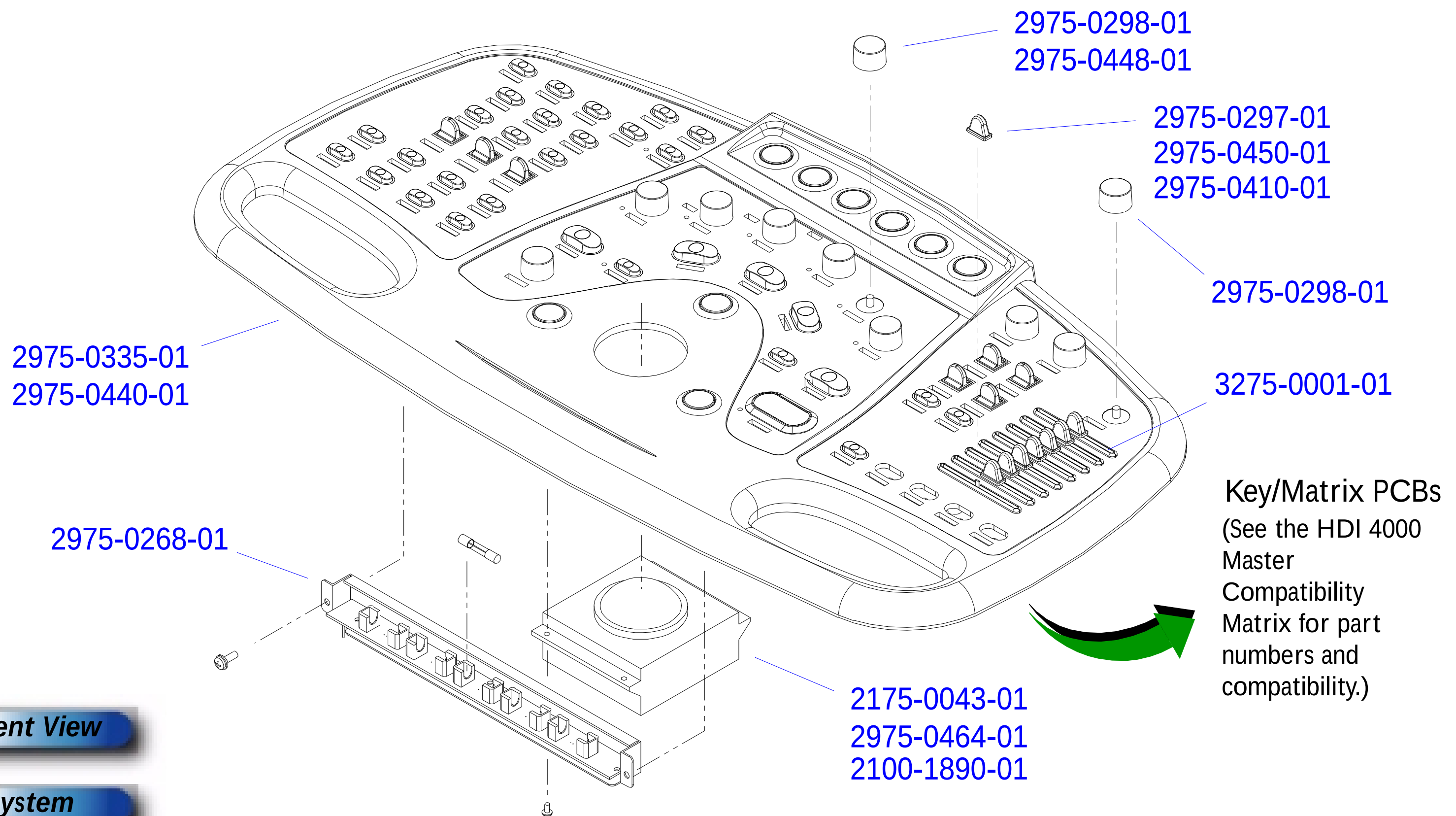
Figure 14-10 Control Panel

PARENT VIEW



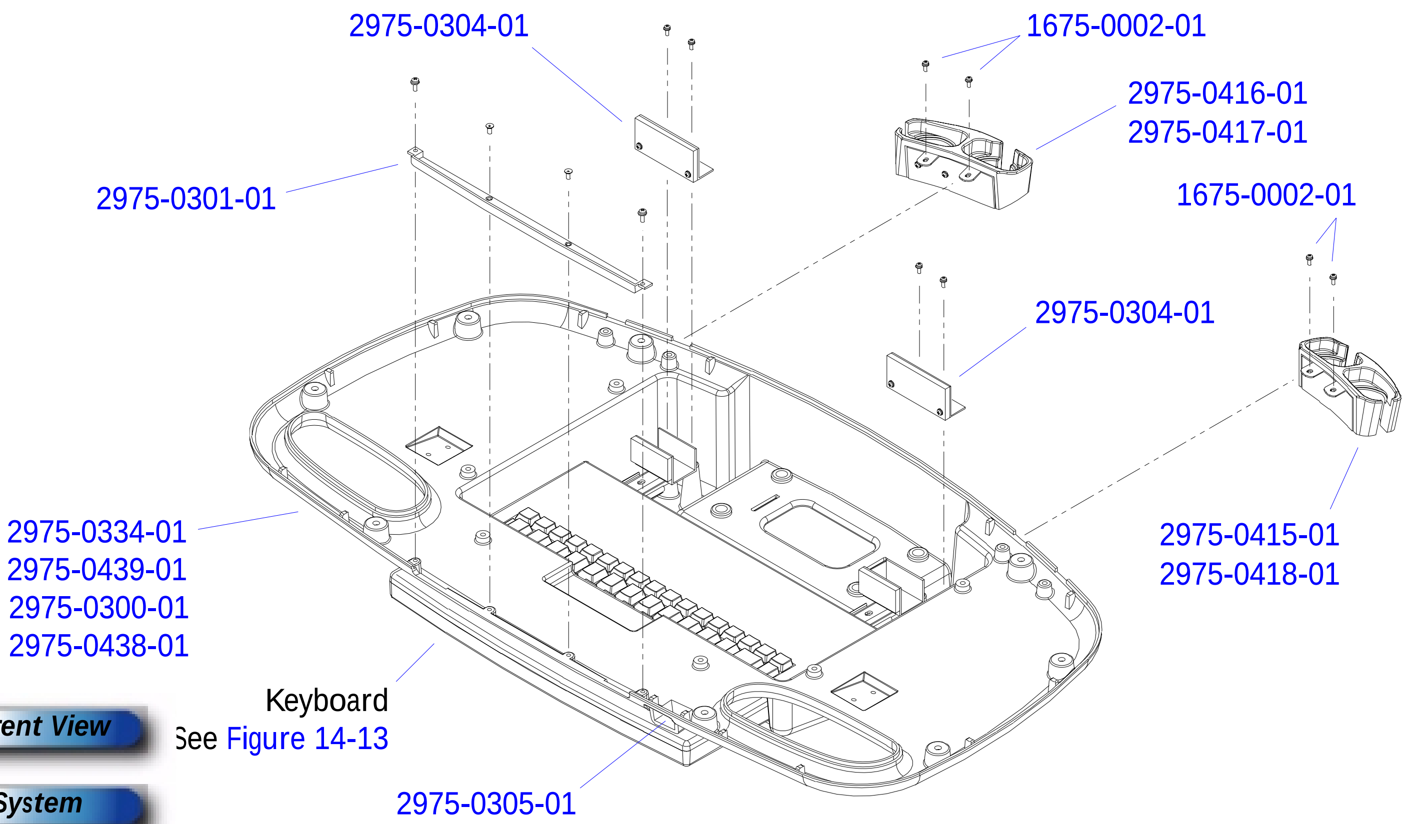
System

Figure 14-11 Control Panel Top



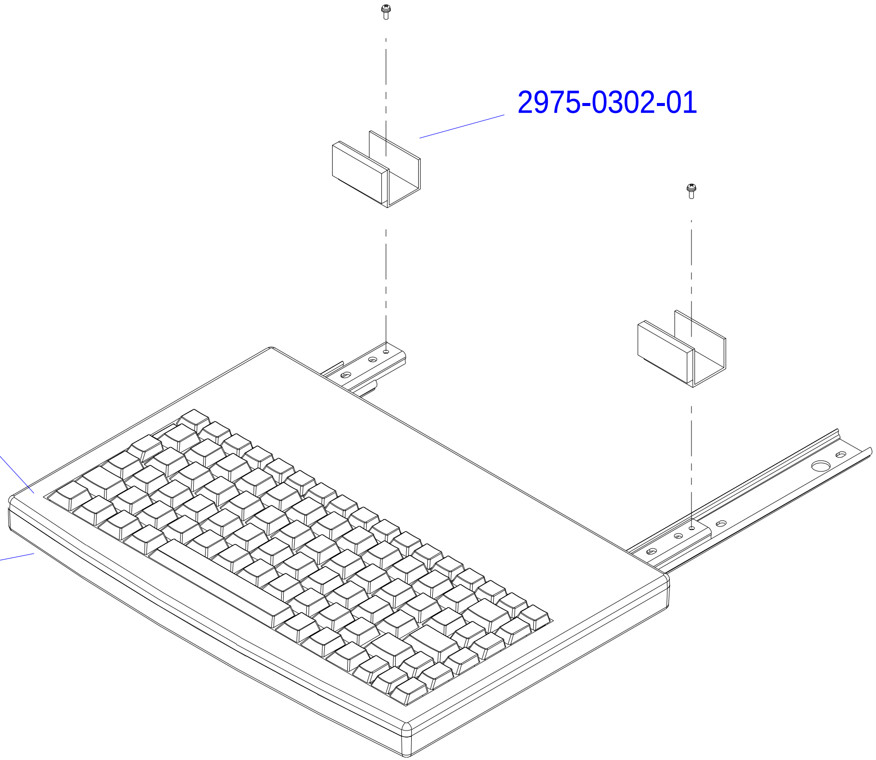
Parent View
System

Figure 14-12 Control Panel Bottom



Parent View
System

Figure 14-13 Keyboard (Control Panel)



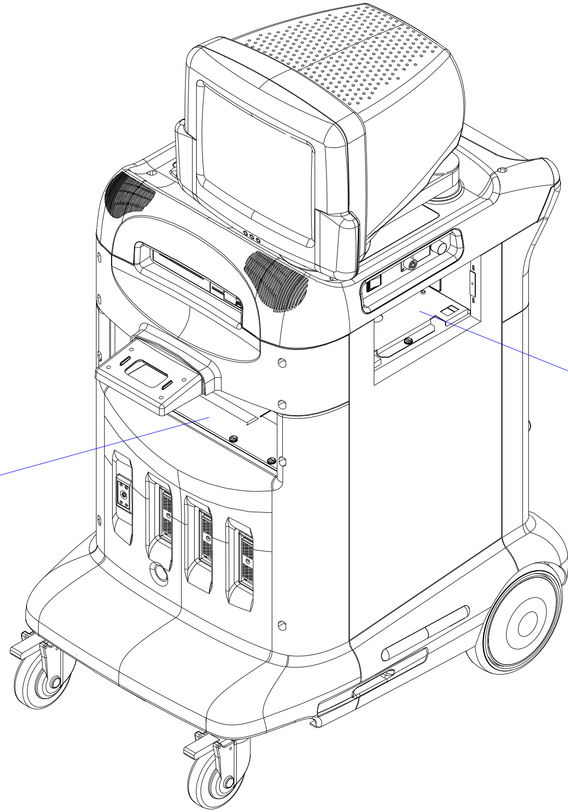
Keyboard assembly
2175-0061-01
2175-0063-01
2175-0066-01
2175-0067-01
2175-0071-01

Keyboard assembly
(Philips colors)
2175-0116-01
2175-0118-01
2175-0120-01
2175-0122-01
2175-0124-01

Parent View
System

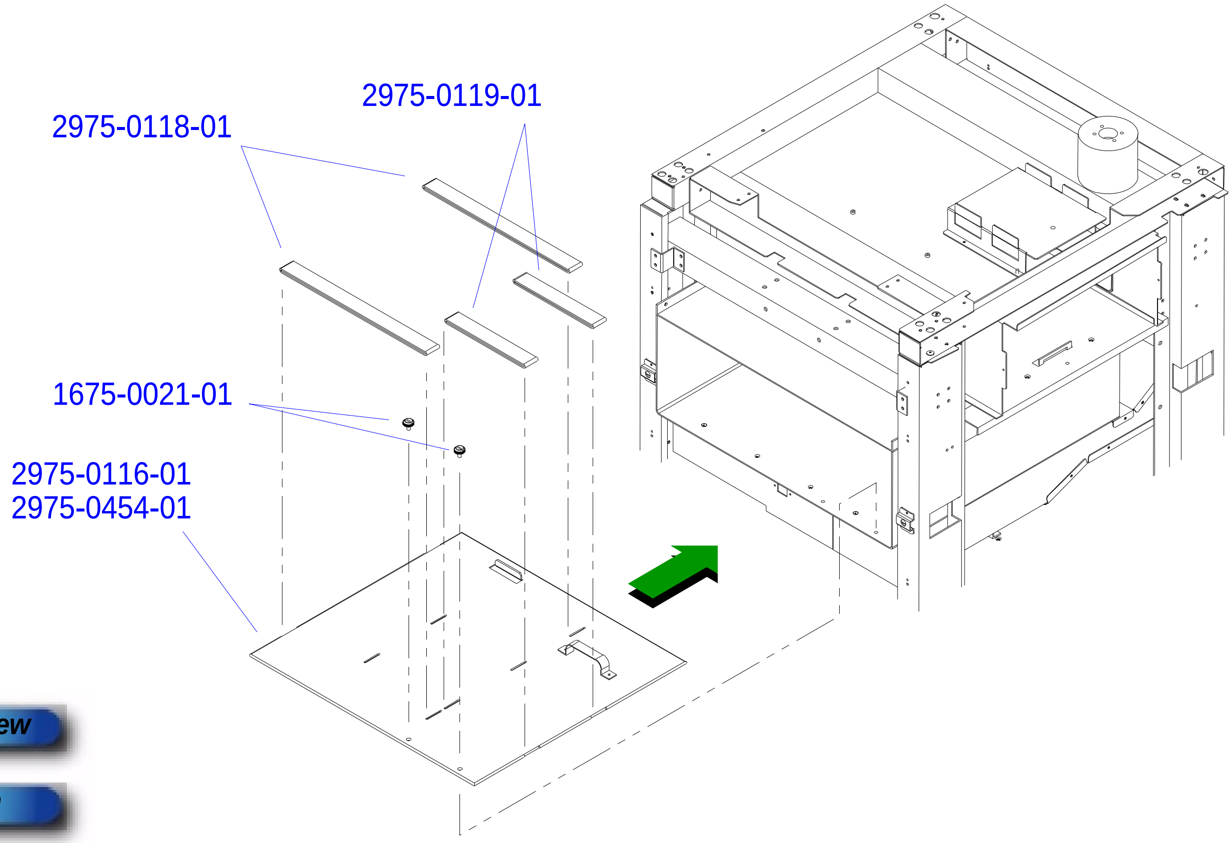
Figure 14-14 OEM Bays

PARENT VIEW



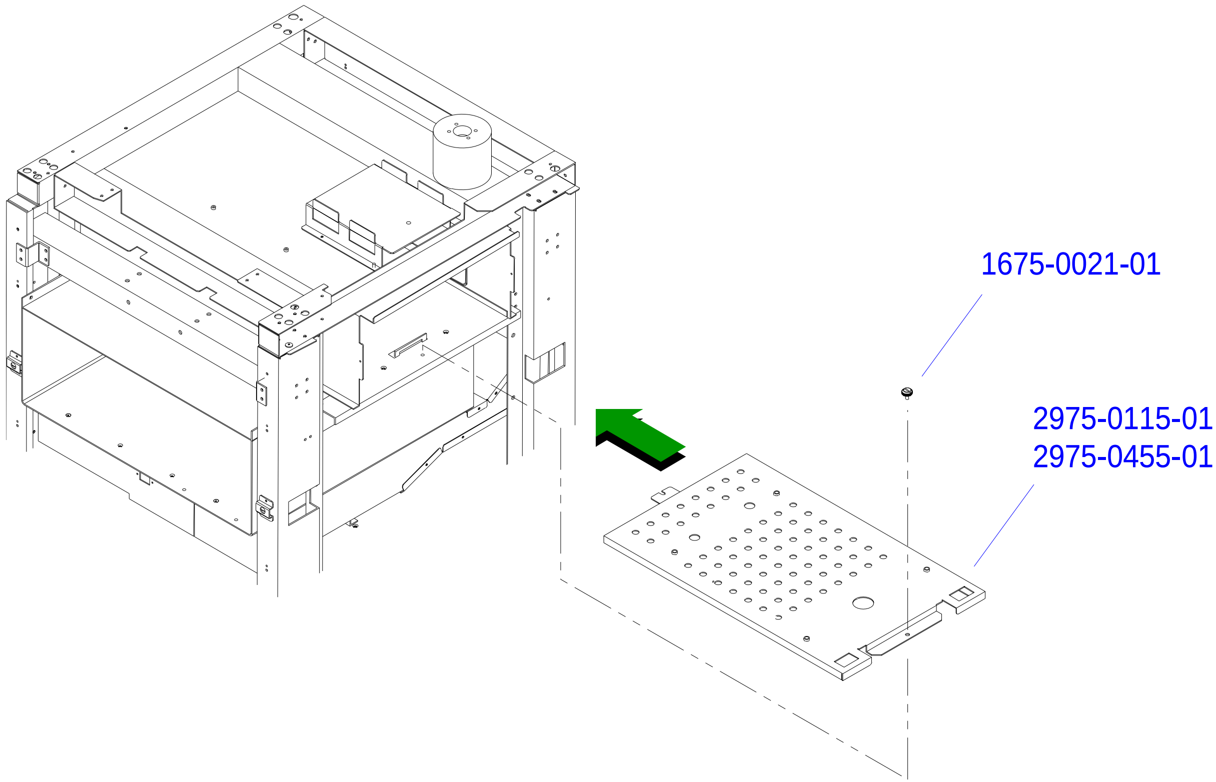
System

Figure 14-15 Printer OEM Bay Support



Parent View
System

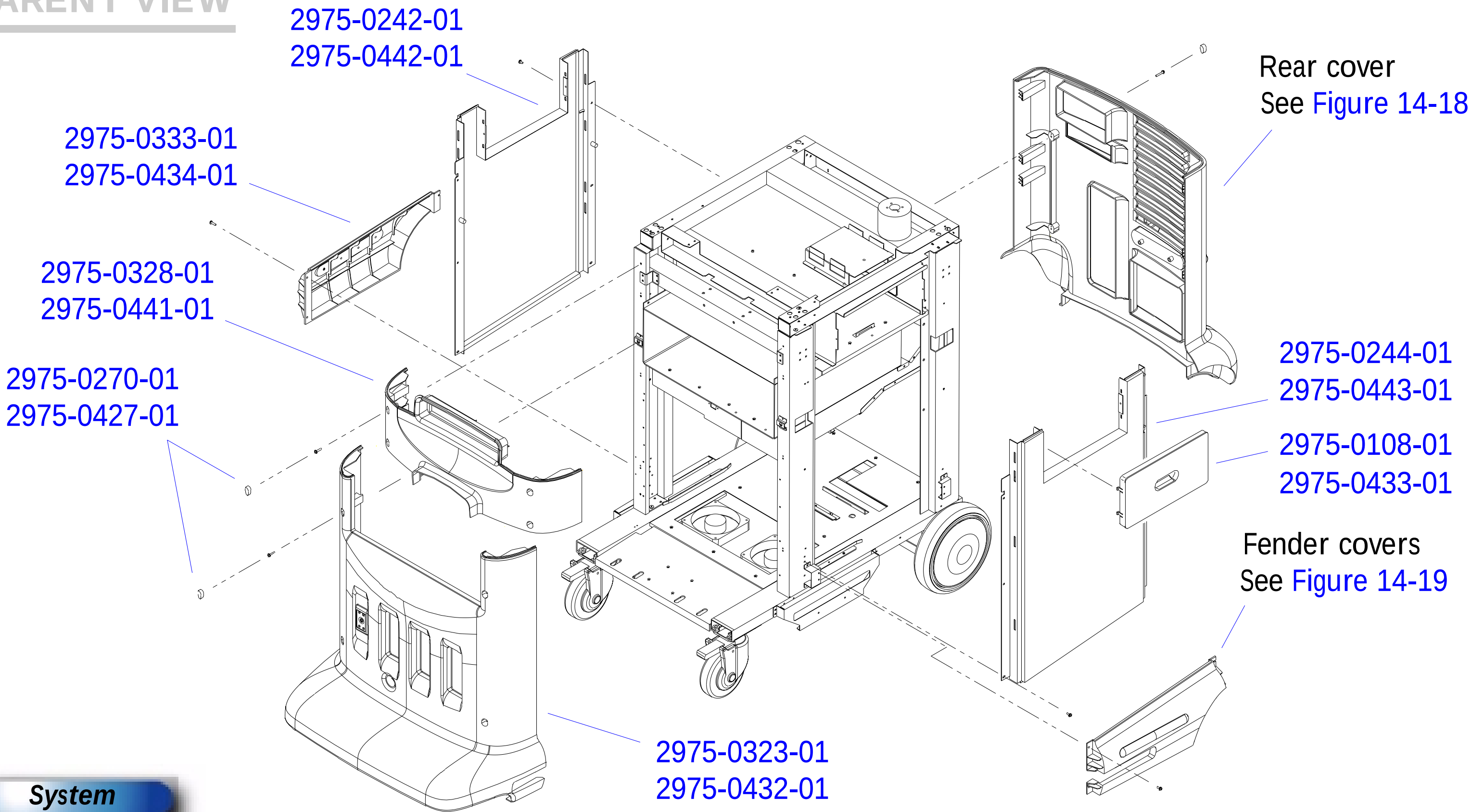
Figure 14-16 VCR OEM Bay Support



Parent View
System

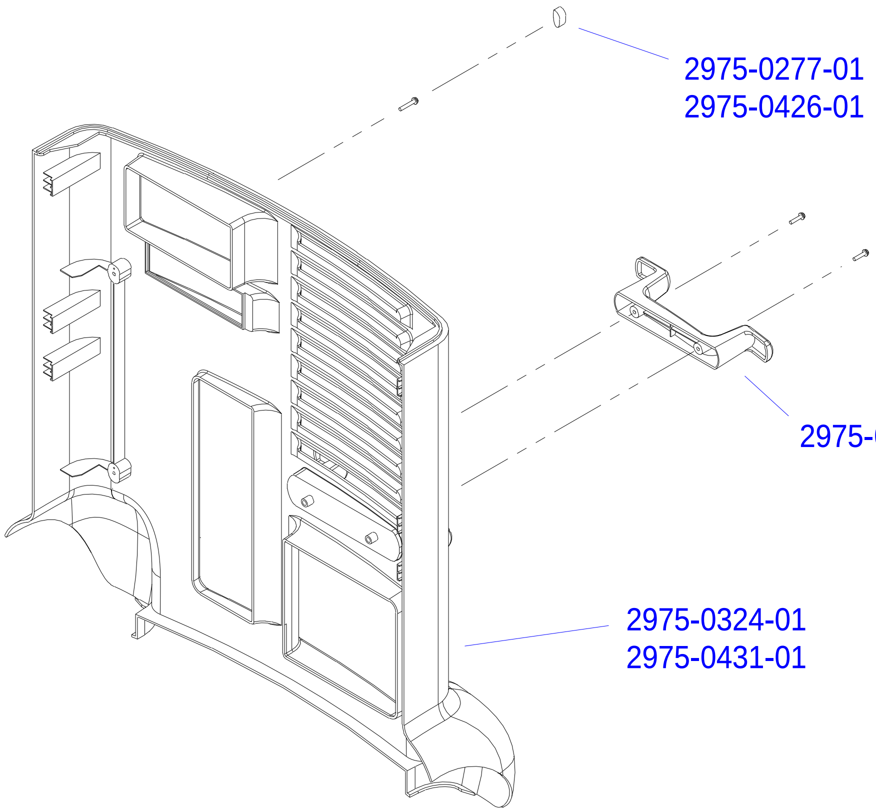
Figure 14-17 **Enclosure Covers**

PARENT VIEW



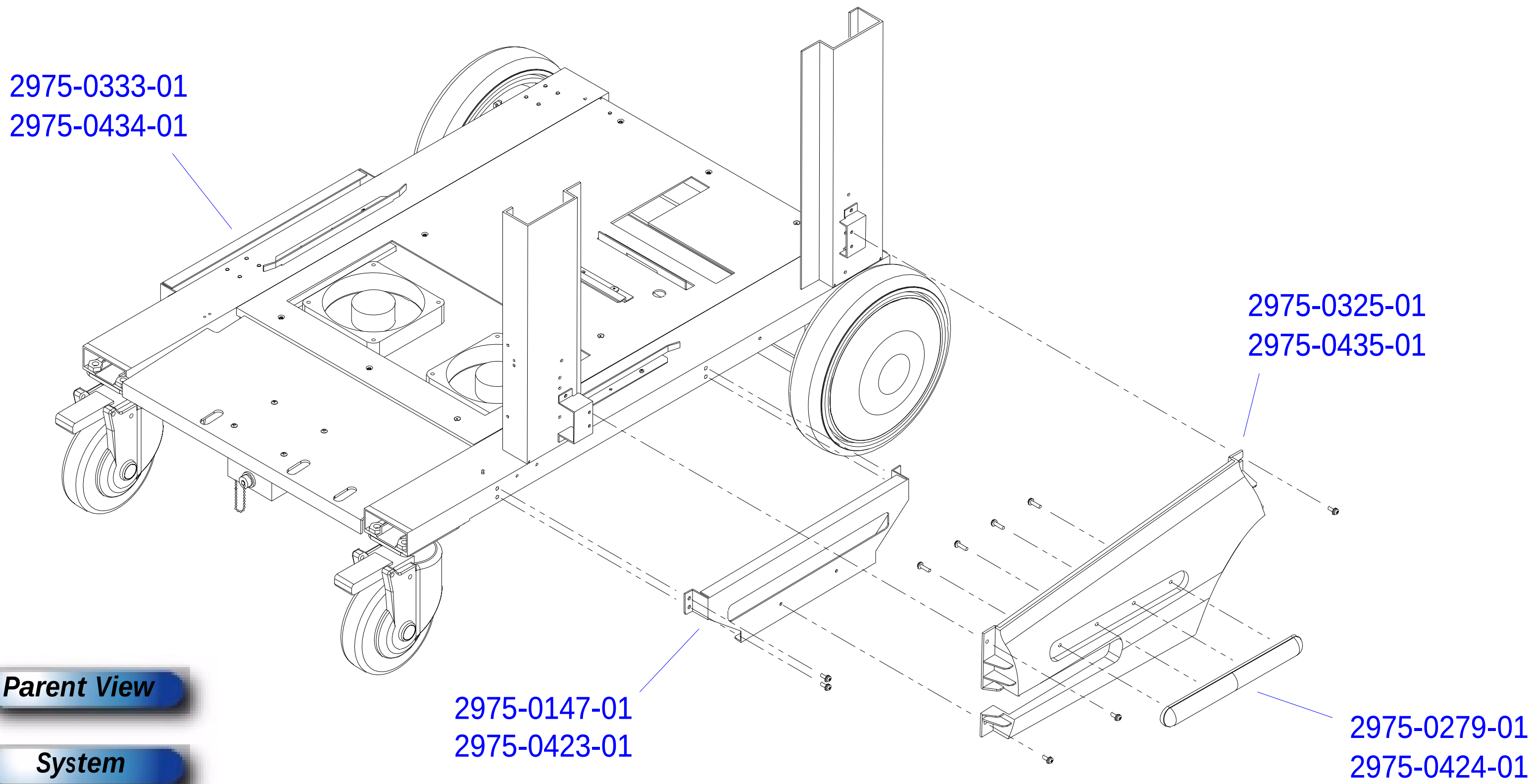
System

Figure 14-18 Rear Cover



Parent View
System

Figure 14-19 Fender Covers



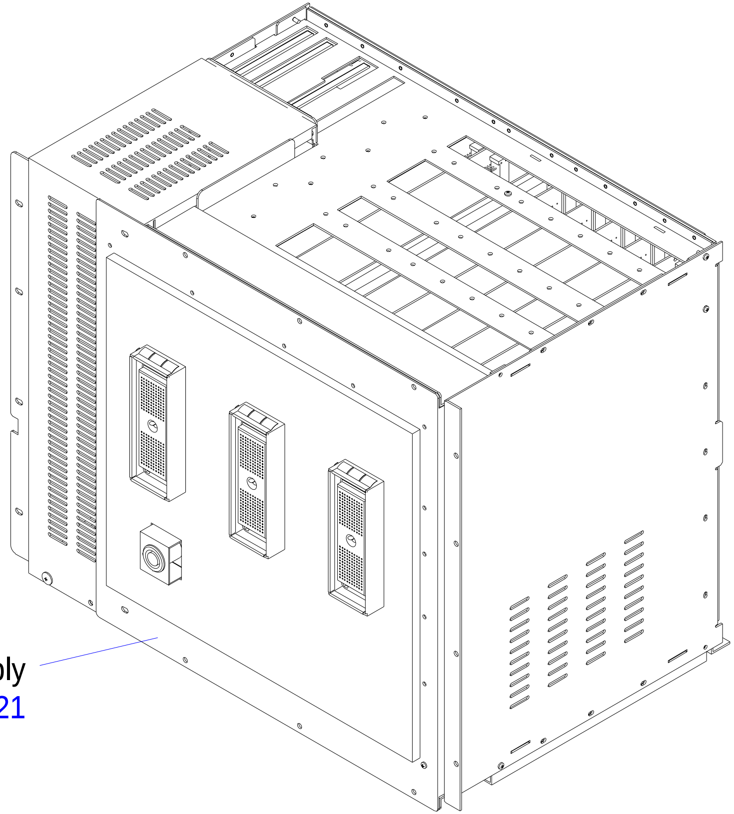
Parent View

System

Figure 14-20 Card Cage

PARENT VIEW

Front card cage
See Figure 14-22

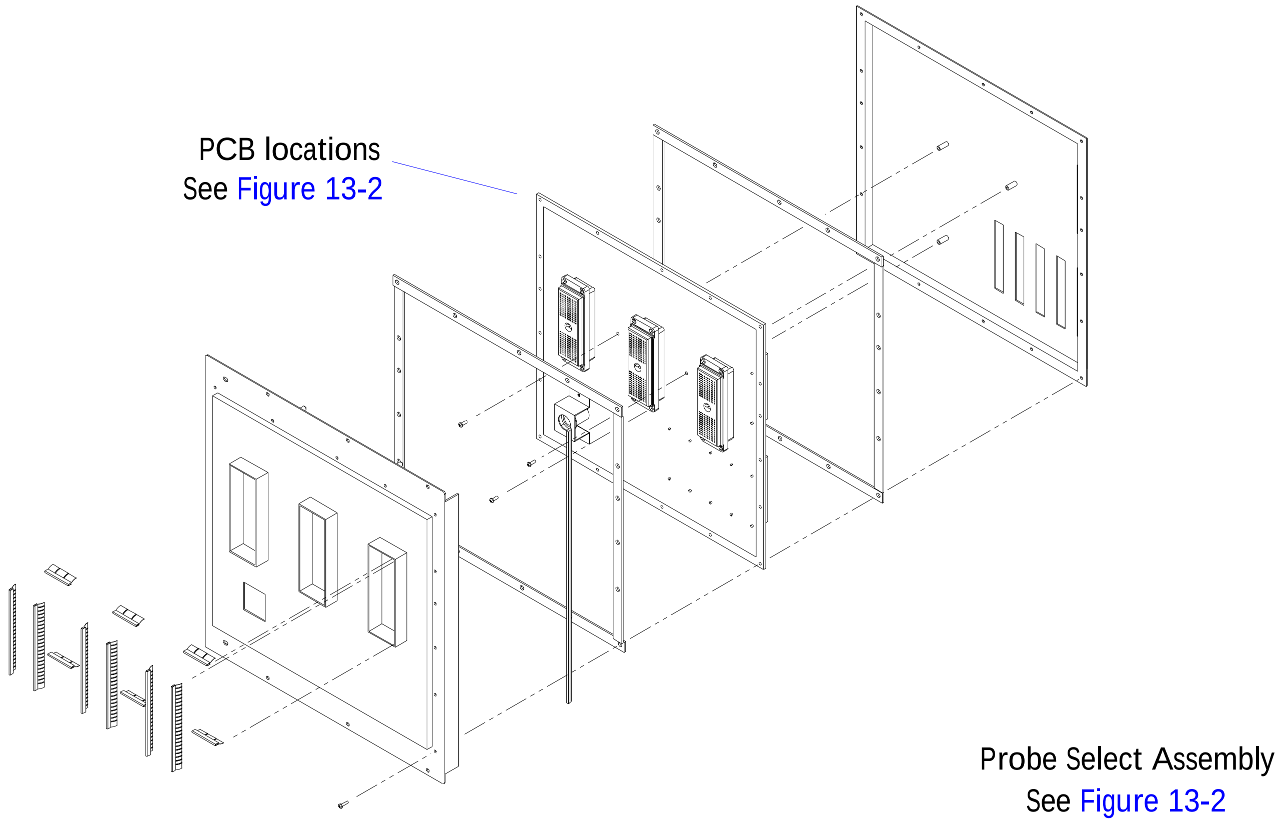


Probe Select Assembly
See Figure 14-21

Rack and rail assembly
2975-0121-01

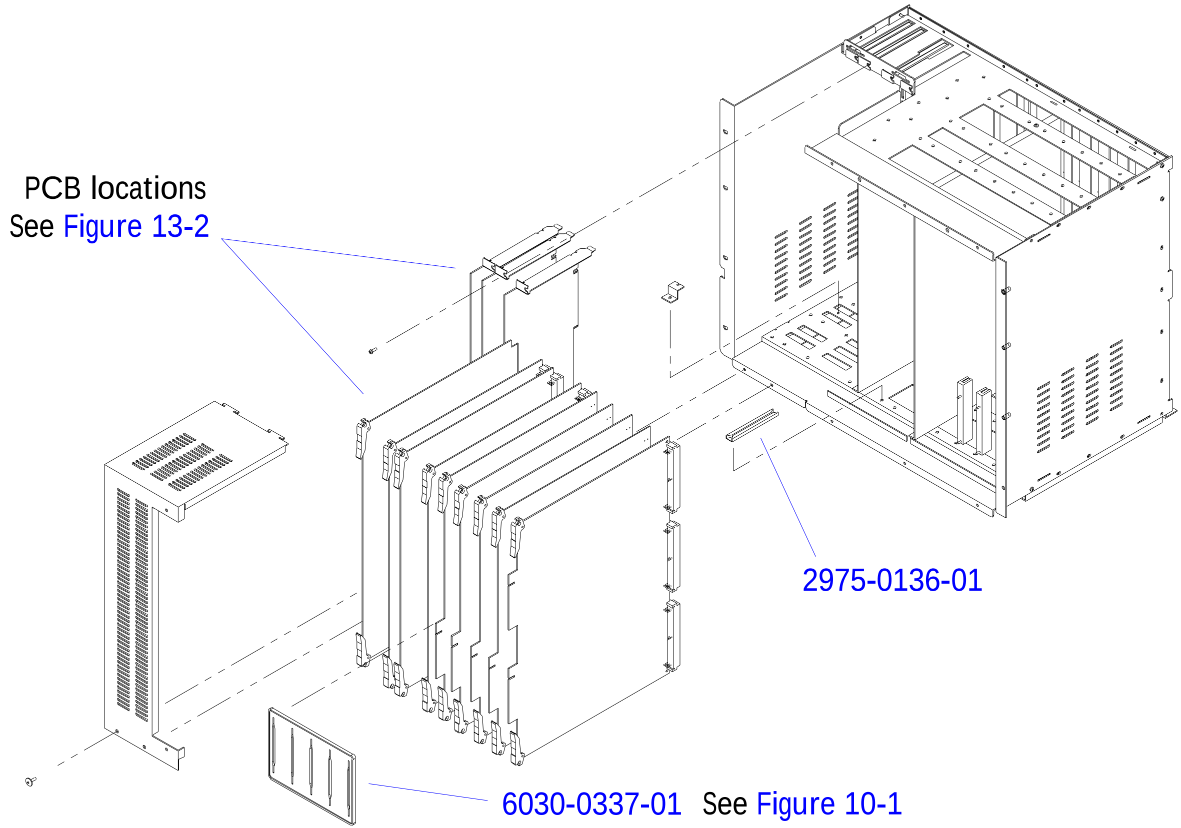
System

Figure 14-21 Probe Select Assembly



Parent View
System

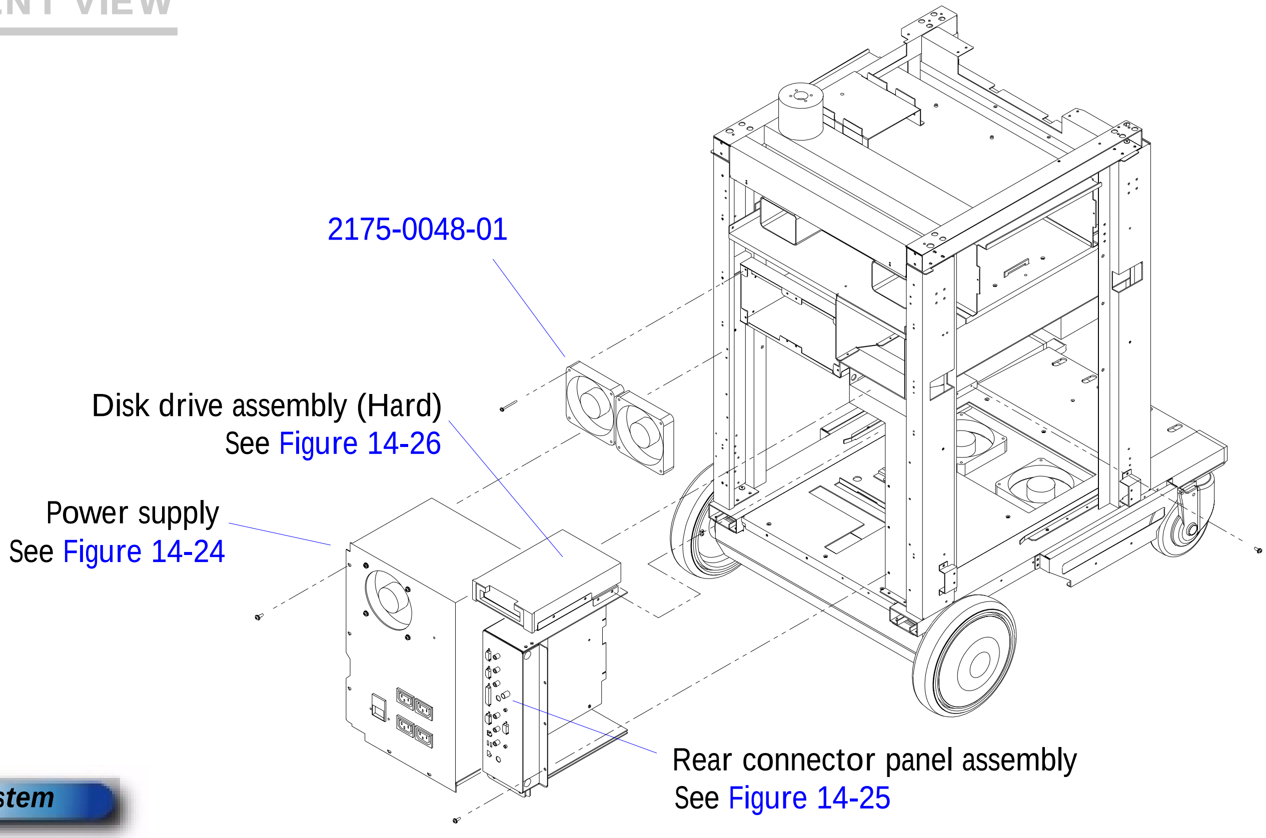
Figure 14-22 Card Cage (Front)



Parent View
System

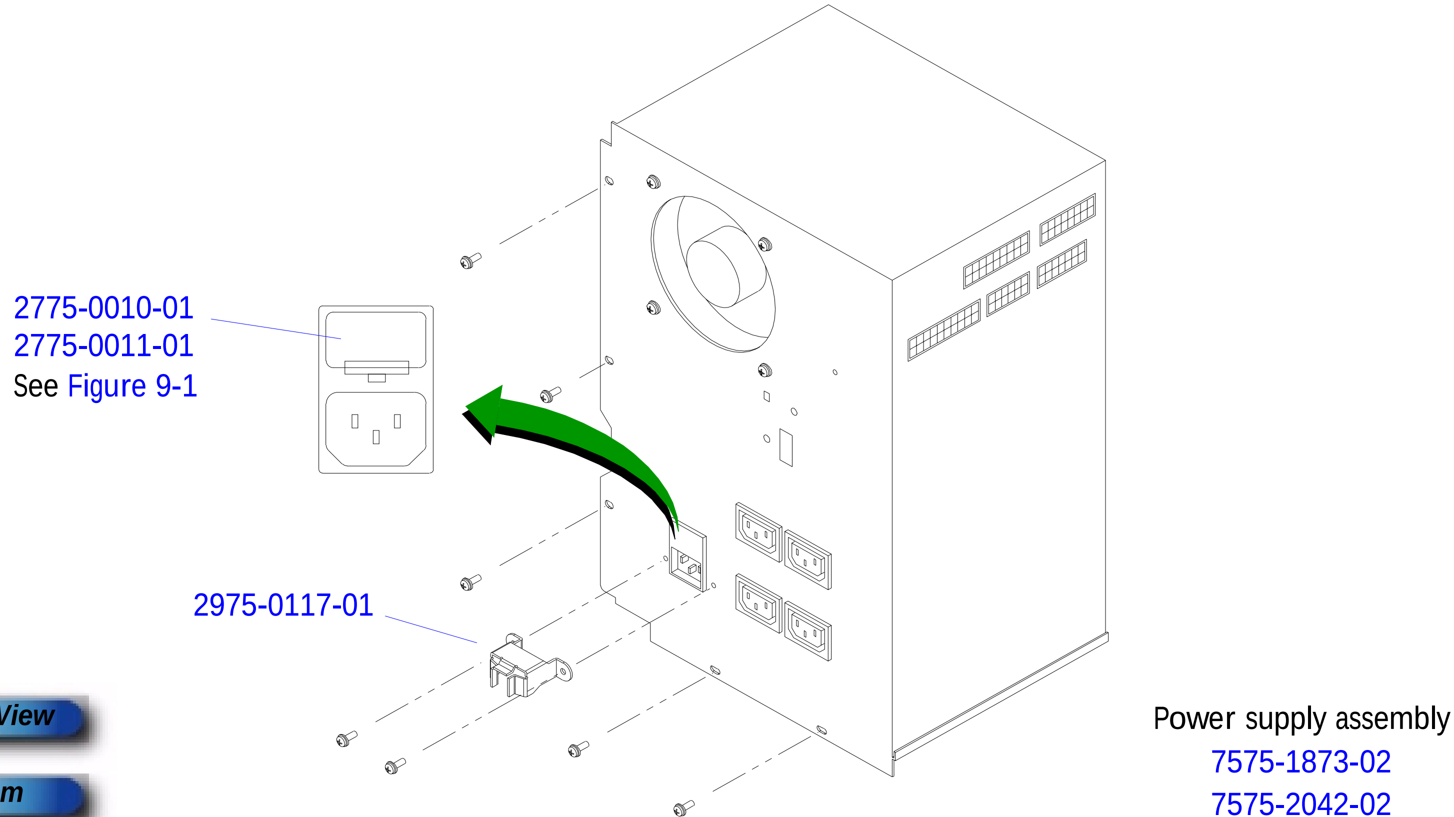
Figure 14-23 **Rear Cart**

PARENT VIEW



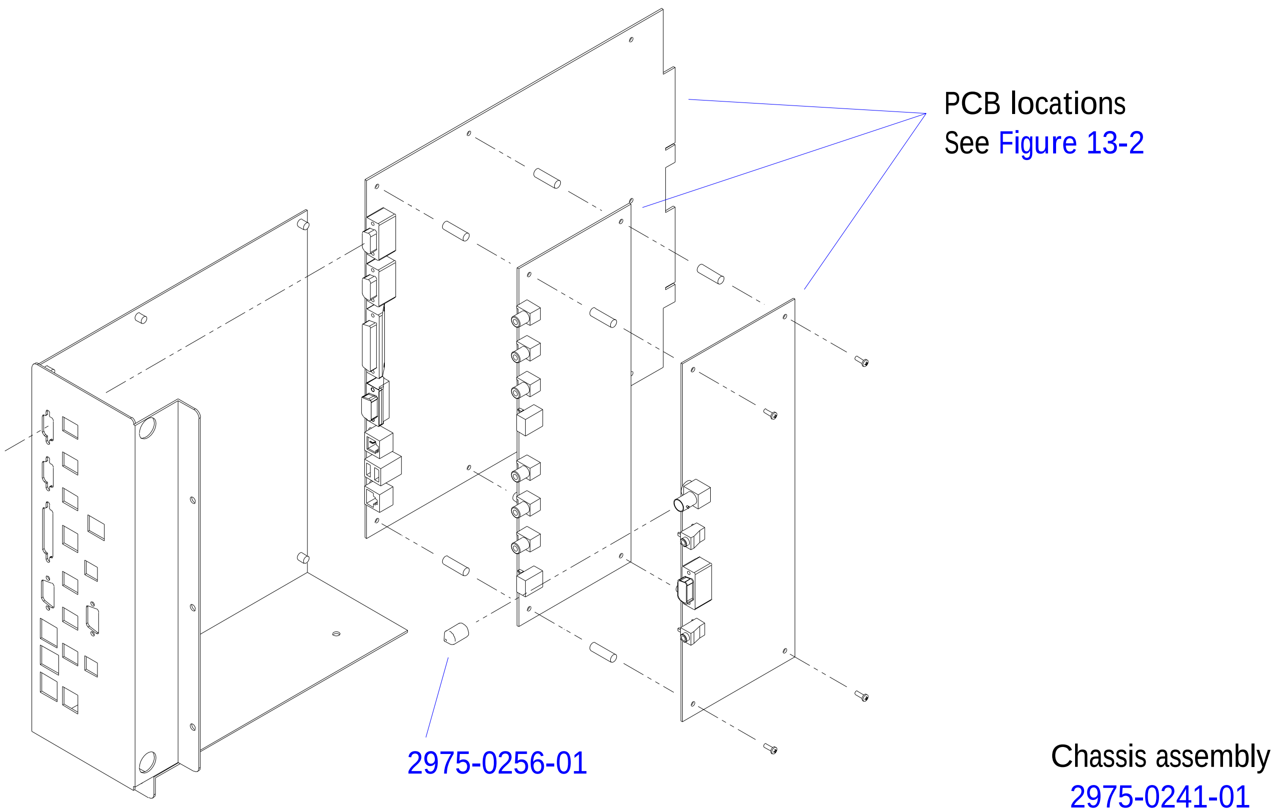
System

Figure 14-24 Power Supply



Parent View
System

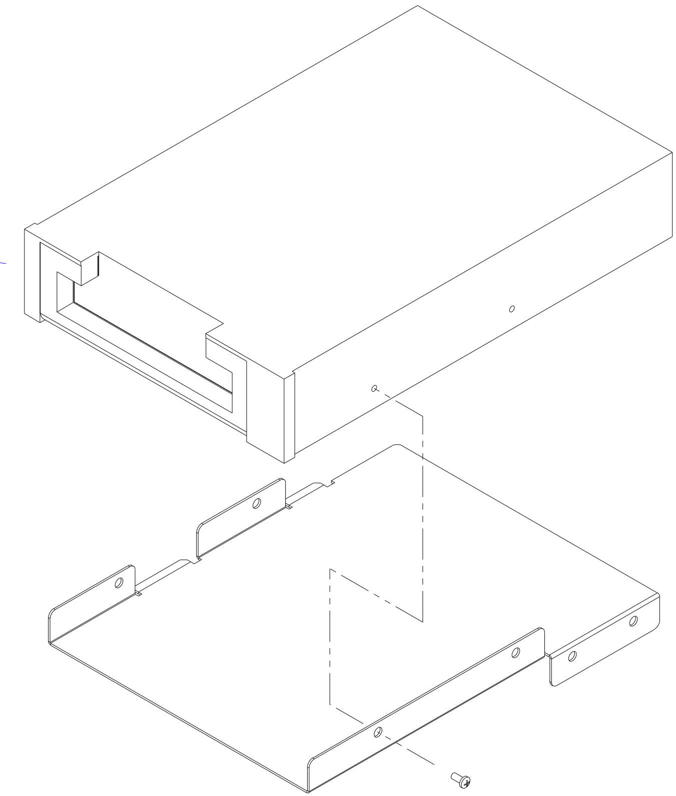
Figure 14-25 Rear Connector Panel Assembly



Parent View
System

Figure 14-26 Disk Drive Assembly (Hard Drive)

2175-0081-01
See Figure 14-34

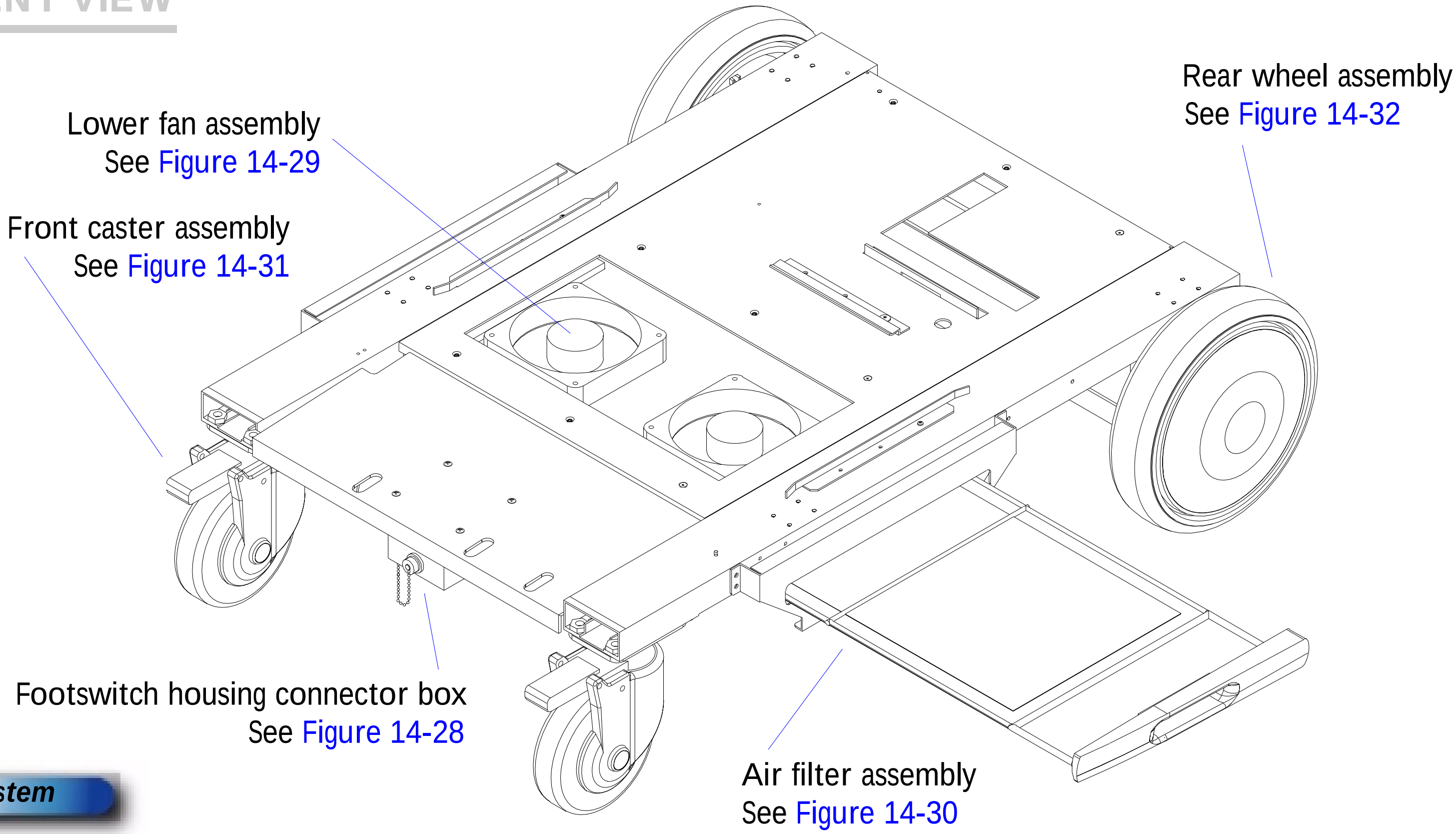


Parent View

System

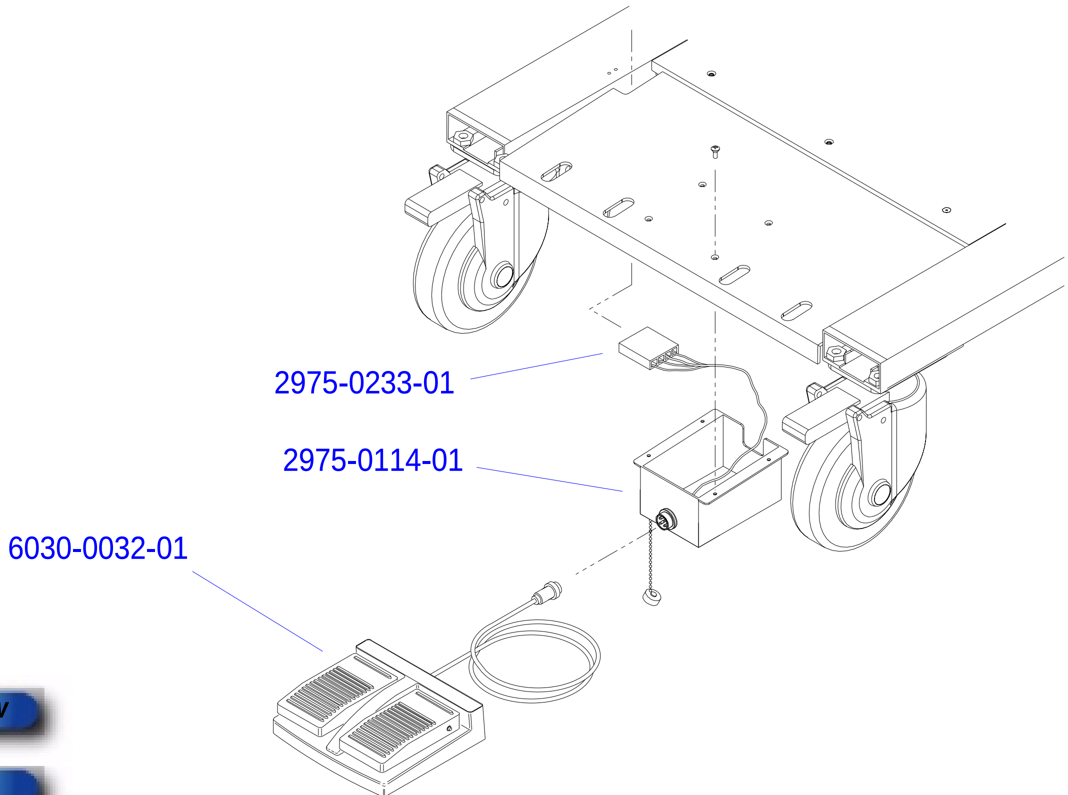
Figure 14-27 Lower Cart

PARENT VIEW



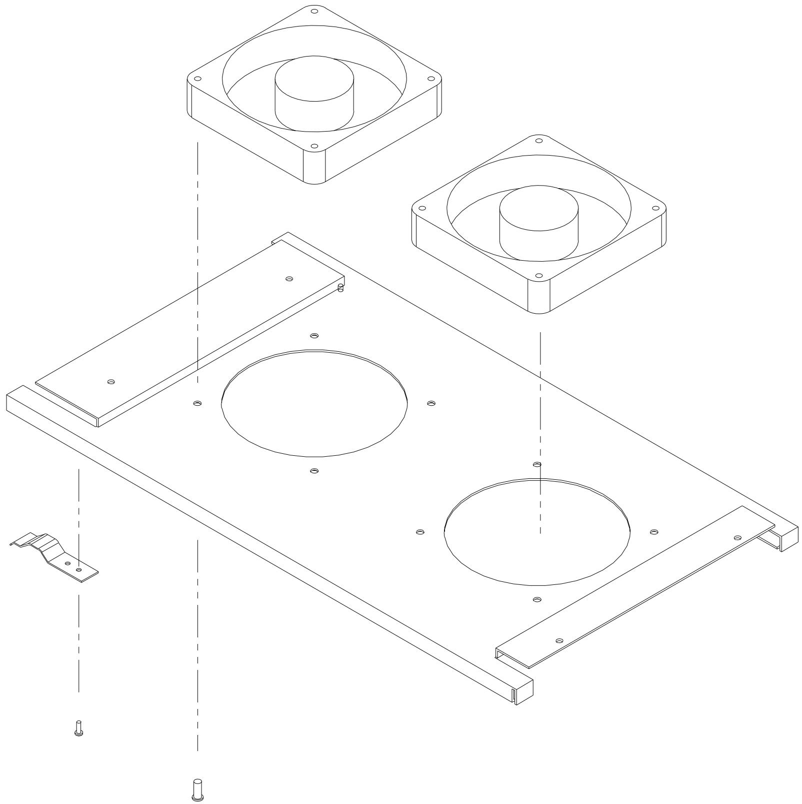
System

Figure 14-28 Footswitch Housing Connector Box



Parent View
System

Figure 14-29 Lower Fan Assembly

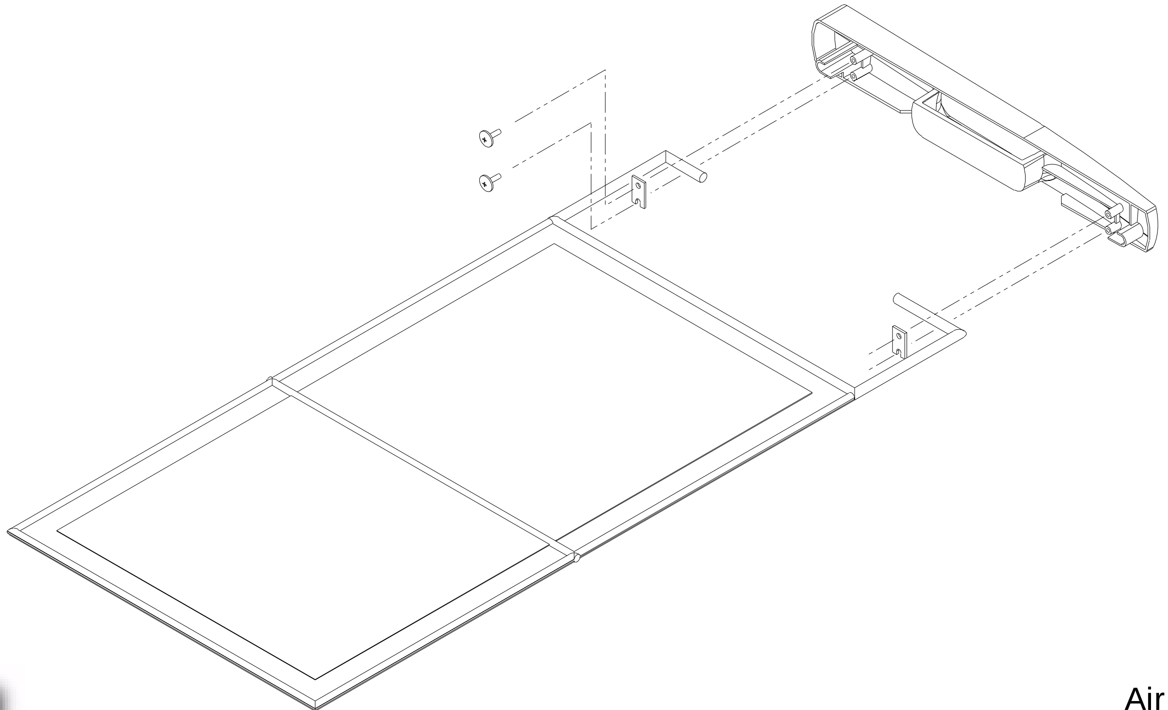


Parent View

System

Lower fan assembly
2175-0049-01

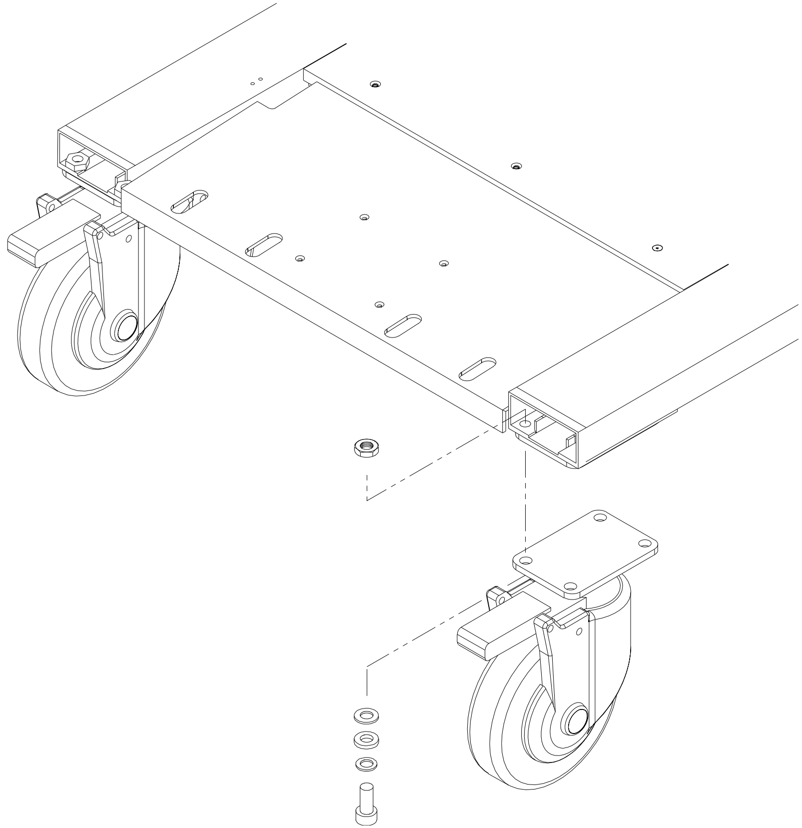
Figure 14-30 Air Filter Assembly



Air filter assembly
2975-0106-01
2975-0421-01

Parent View
System

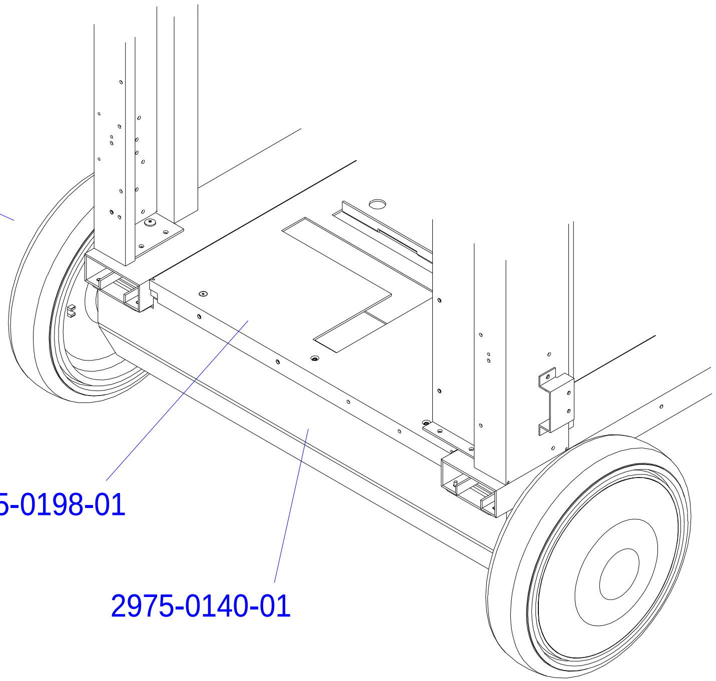
Figure 14-31 **Front Caster Assembly**



Caster assembly (5-inch)
2975-0189-01
2975-0430-01

Parent View
System

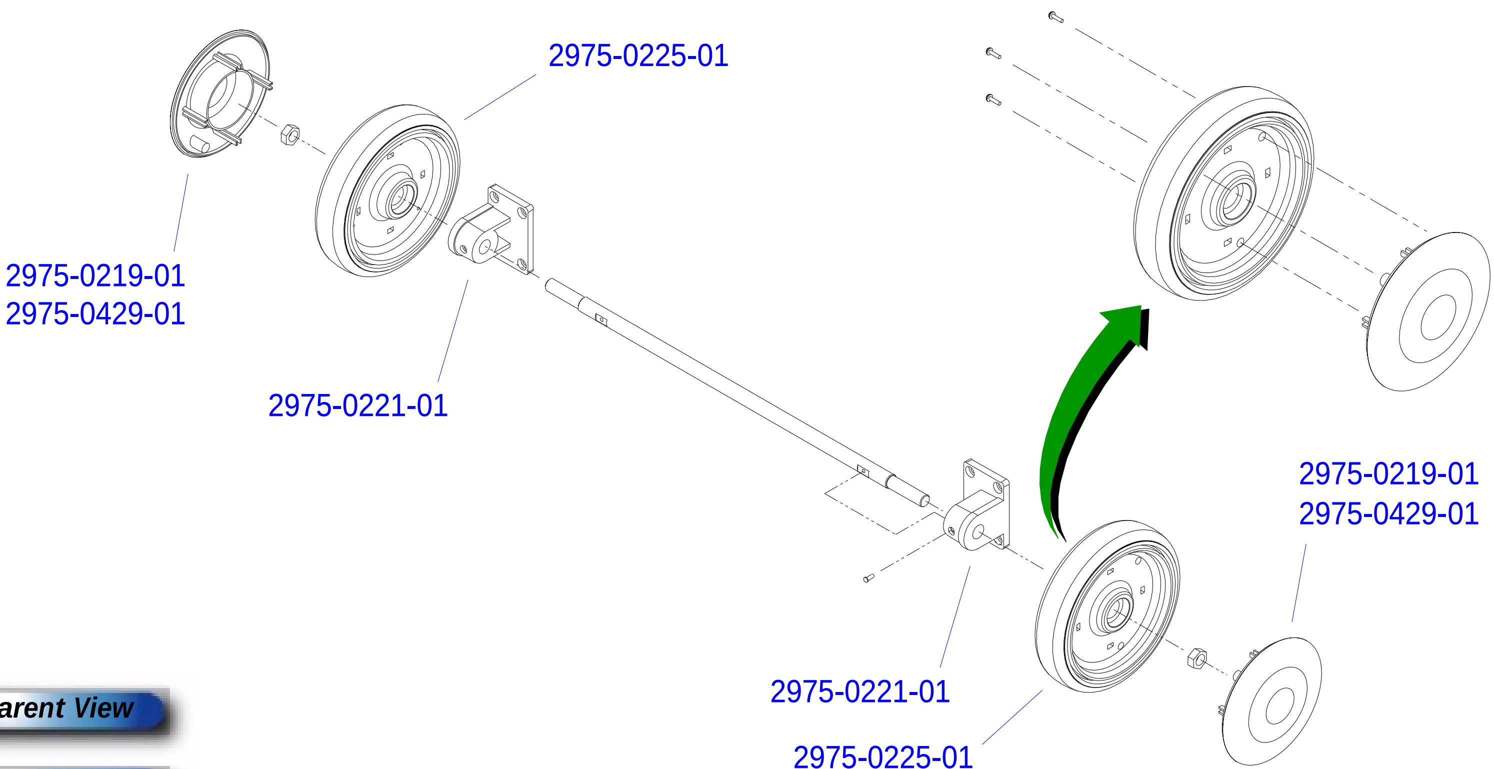
Figure 14-32 **Rear Wheel Assembly**



Parent View

System

Figure 14-33 Wheel Assembly (Exploded)



Parent View
System

Figure 14-34 Hard Disk Drive Assembly (Shipping Container)

System

Figure 14-35 **HDI 4000 Accessory Kit**

1.3 GB MO disk

Windows 2000 certification label

2275-0519-01

System cover

2275-0516-01

2275-0276-01

2975-0447-01
2975-0460-01

6030-0032-01

Scanning gel

OEM cables will not be in the kit if installation is required at pre-ship.

2975-0252-01

2275-0482-01

System power cables are pre-installed.

2275-0510-01
2275-0511-01

Cable hanger screws

2275-0275-01

2775-0010-01
2775-0011-01

System

Table 14-1 HDI 4000 System Parts List

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-30	2975-0106-01	Air Filter, Bottom, Assy, HDI 4000	A325-001A
Figure 14-30	2975-0421-01	Air Filter, Bottom, Assy, Philips 4000	A325-002A (Philips Colors)
Figure 14-5	2975-0290-01	Arm, Swivel, Monitor, HDI 4000	229-D-011B
Figure 14-5	2975-0422-01	Arm, Swivel, Monitor, Philips 4000	229-D-011D (Philips Colors)
Figure 14-5	2975-0295-01	Bolt, Special, Thumb, HDI 4000	366-L-002-1A
Figure 14-5	1575-0003-01	Bolt, Special, Thumb, Philips 4000	366-L-002-1 (Philips Colors)
Figure 14-8	2975-0316-01	Bracket, FDD, CD Assy, HDI 4000	A235-014A
Figure 14-19	2975-0147-01	Bracket, Fender	235-P-152A
Figure 14-19	2975-0423-01	Bracket, Fender, Philips 4000	235-P-152-1 (Philips Colors)
Figure 14-9	2975-0145-01	Bracket, I/F Support, SA9900, HDI 4000	235-P-126-1A
Figure 14-24	2975-0117-01	Bracket, Plug, HDI 4000	235-P-149B
Figure 14-12	2975-0417-01	Bracket, Probe Holder, Rubber, Left, HDI 4000	235-P-262A
Figure 14-12	2975-0418-01	Bracket, Probe Holder, Rubber, Right, HDI 4000	235-P-263A
Figure 14-33	2975-0221-01	Bracket, Wheel, 9-inch, HDI 4000	235-D-141-1B

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-19	2975-0279-01	Bumper, Rubber, Side	311-R-159A
Figure 14-19	2975-0424-01	Bumper, Rubber, Side, Philips 4000	311-R-159-1 (Philips Colors)
Figure 11-2	Table 11-2	Cables, Power Distribution	
Figure 11-1	Table 11-1	Cables, Signal Interconnect	
Figure 14-5	6030-0280-01	Cap, Arm, Monitor, HDI 4000	269-M-005A-HD
Figure 14-5	2975-0425-01	Cap, Arm, Monitor, Philips 4000	269-M-018-3HD (Philips Colors)
Figure 14-25	2975-0256-01	Cap, BNC, 4800HD	(Part of accessory kit) RU-48P-BNC CAP
Figure 14-6 Figure 14-18	2975-0277-01	Cap, Rubber, Back	311-R-158A
Figure 14-6 Figure 14-18	2975-0426-01	Cap, Rubber, Back, Philips 4000	311-R-158-1 (Philips Colors)
Figure 14-17	2975-0270-01	Cap, Rubber, Front	311-R-157A
Figure 14-17	2975-0427-01	Cap, Rubber, Front, Philips 4000	311-R-157-1 (Philips Colors)
Figure 14-6	2975-0240-01	Cap, Rubber, Top, Rear	311-R-156A
Figure 14-6	2975-0428-01	Cap, Rubber, Top, Rear, Philips 4000	311-R-156-1 (Philips Colors)
Figure 14-33	2975-0219-01	Cap, Wheel, 9-inch, HDI 4000	269-M-037B

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-33	2975-0429-01	Cap, Wheel, 9-inch, Philips 4000	269-M-037D (Philips Colors)
Figure 14-31	2975-0189-01	Caster Assy, 5-inch, HDI 4000 (Front caster assembly)	A374-004A
Figure 14-31	2975-0430-01	Caster Assy, Front, 5-inch, Philips 4000	A374-008A (Philips Colors)
Figure 14-33	2975-0225-01	Caster Assy, 9-inch, Wheel, HDI 4000 (Rear wheel assembly)	A374-002A
Figure 14-25	2975-0241-01	Chassis Assy, I/F Board, HDI 4000	A223-010A
Figure 14-15	2975-0118-01	Clamp, Color Printer, HDI 4000	334-Z-026A
Figure 14-15	2975-0119-01	Clamp, Echo Printer, HDI 4000	334-Z-027A
Figure 14-18	2975-0324-01	Cover, Bottom, Back, HDI 4000	215-M-214A
Figure 14-18	2975-0431-01	Cover, Bottom, Back, Philips 4000	215-M-214-1 (Philips Colors)
Figure 14-9	Not yet assigned	Cover, Bottom, ECG Module	213-P-131A
Figure 14-17	2975-0323-01	Cover, Bottom, Front, HDI 4000	215-M-216A
Figure 14-17	2975-0432-01	Cover, Bottom, Front, Philips 4000	215-M-216-1 (Philips Colors)
Figure 14-32	2975-0140-01	Cover, Caster, HDI 4000	215-P-160-1B
Figure 14-17	2975-0108-01	Cover, Door, Side	215-M-219A (Part of accessory kit)

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-17	2975-0433-01	Cover, Door, Side, Philips 4000	215-M-219-1 (Part of accessory kit) (Philips Colors)
Figure 14-9	2975-0273-01	Cover, ECG, Power, Assy, HDI 4000	A215-039A
Figure 14-17 Figure 14-19	2975-0333-01	Cover, Fender, Left, HDI 4000	215-M-218A
Figure 14-17 Figure 14-19	2975-0434-01	Cover, Fender, Left, Philips 4000	215-M-218-1 (Philips Colors)
Figure 14-19	2975-0325-01	Cover, Fender, Right, HDI 4000	215-M-217A
Figure 14-19	2975-0435-01	Cover, Fender, Right, Philips 4000	215-M-217-1 (Philips Colors)
Figure 14-13	2975-0326-01	Cover, Keyboard, Alpha, Bottom, HDI 4000	215-M-224A
Figure 14-13	2975-0436-01	Cover, Keyboard, Alpha, Bottom, Philips 4000	215-M-224-1 (Philips Colors)
Figure 14-13	2975-0327-01	Cover, Keyboard, Alpha, Top, HDI 4000	215-M-223A
Figure 14-13	2975-0437-01	Cover, Keyboard, Alpha, Top, Philips 4000	215-M-223-1 (Philips Colors)
Figure 14-12	2975-0300-01	Cover, Keyboard, Bottom Assy	A260-034A
Figure 14-12	2975-0438-01	Cover, Keyboard, Bottom Assy, Philips 4000	A260-060A (Philips Colors)

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-12	2975-0334-01	Cover, Keyboard, Bottom, HDI 4000	260-D-009A
Figure 14-12	2975-0439-01	Cover, Keyboard, Bottom, Philips 4000	260-D-009-1 (Philips Colors)
Figure 14-11	2975-0335-01	Cover, Keyboard, Top, HDI 4000	260-M-010A
Figure 14-11	2975-0440-01	Cover, Keyboard, Top, Philips 4000	260-M-010-1 (Philips Colors)
Figure 14-12	2975-0301-01	Cover, Lamp	215-M-227A
Figure 14-17	2975-0328-01	Cover, Middle, Front, HDI 4000	215-M-212A
Figure 14-17	2975-0441-01	Cover, Middle, Front, Philips 4000	215-M-212-1 (Philips Colors)
Figure 14-17	2975-0242-01	Cover, Side Panel, Left	215-P-226A
Figure 14-17	2975-0442-01	Cover, Side Panel, Left, Philips 4000	215-P-226-1 (Philips Colors)
Figure 14-17	2975-0244-01	Cover, Side Panel, Right	215-P-225A
Figure 14-17	2975-0443-01	Cover, Side Panel, Right, Philips 4000	215-P-225-1 (Philips Colors)
Figure 14-9	Not yet assigned	Cover Top, ECG Module	213-P-124A
Figure 14-6	2975-0387-01	Cover, Top, HDI 4000	215-M-211A
Figure 14-6	2975-0444-01	Cover, Top Assy, Philips 4000	A215-094A (Philips Colors)
Figure 14-6	2975-0384-01	Cover, Upper, Back, HDI 4000	215-M-215A

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-6	2975-0445-01	Cover, Upper Assy, Back, Philips 4000	A215-100A (Philips Colors)
Figure 14-5	2975-0296-01	C-Ring, 9PHI	EL-C-RING9
Figure 14-8	2175-0113-01	Disk Drive, CDDR, CDR8X, CDRWX4, Read32XLG, HDI 4000	PC-CD/RW-GCE8321B
Figure 14-8	2175-0130-01	Disk Drive, CDDR, CDR40X, CDRW12X, Read40XLG, HDI 4000	PC-CD/RW-GCE8401B
Figure 14-8	2175-0054-01	Disk Drive, CDR-8X/CDRW-4X, Read-32X, Large	PC-CD/RW-CED8080B
Figure 14-26 Figure 14-34	2175-0081-01	Disk Drive, Hard, IBM 40G HDD	Revenue systems at release
Figure 14-26 Figure 14-34	2175-0083-01	Disk Drive, Hard, Maxtor 20G HDD	Non-revenue, pre-release systems
Figure 14-26 Figure 14-34	2175-0053-01	Disk Drive, Hard, Quantum 20.4G HDD	Early demo systems
Figure 14-8	2175-0055-01	Disk Drive, MO, Fujitsu, IDE	PC-MO-MCD3139AP
Figure 14-35	2275-0519-01	Electroed Type, ECG	(Part of accessory kit) ECG-ELECTROED
Figure 14-23	2175-0048-01	Fan Assy, Back, SA9900	AY-FAN-432-BACK
Figure 14-29	2175-0049-01	Fan Assy, Bottom, SA9900	AY-FAN-332-BOTT
Figure 14-22	2975-0307-01	Fan, Aw0512mb-G76 (Ts), Pentium	FAN-AW0512MB (Located on the PC PCB)

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-5	2975-0291-01	Fixture, Swivel, Limit, SA9900	239-L-008A
Figure 14-28	6030-0032-01	Foot switch	
Figure 14-32	2975-0198-01	Frame, Body Bottom, HDI 4000	225-P-031-1A
Figure 14-24 Figure 14-35	2775-0010-01	Fuse, Schurter, 50t10l250v, 0034.3127	(Part of accessory kit) FUSE-50T10L
Figure 14-24 Figure 14-35	2775-0011-01	Fuse, Triad, 50T, T5l250V	(Part of accessory kit) FUSE-50T5L
Figure 14-22	6030-0337-01	Guide, B/F Board, SA8800	227-M-050A
Figure 14-22	2975-0136-01	Guide, Rail, PCB-2T, CG-7A, HDI 4000	227-Z-027A
Figure 14-5	2975-0319-01	Guide, Rotate, Lock and Mount, Ay9900	A227-003A
Figure 14-5	2975-0075-01	Guide, Swivel, HDI 1500	227-M-066A
Figure 14-6	2975-0255-01	Handle Assy, HDI 4000	A252-007A
Figure 14-6	2975-0446-01	Handle Assy, Philips 4000	A252-007-1 (Philips Colors)
Figure 14-18	2975-0276-01	Hanger, Cable	255-M-010A (Power cord cable hanger, rear panel)
Figure 14-35	2975-0460-01	Hanger, Cable, HDI 4000	255-M-011-1 (Scanhead cable hanger)

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-35	2975-0447-01	Hanger, Cable, Philips 4000	255-M-010-1 (Scanhead cable hanger) (Philips Colors)
Figure 14-12	2975-0416-01	Holder, Probe, Rubber, left, HDI 4000	231-R-053A
Figure 14-12	2975-0415-01	Holder, Probe, Rubber, Right, HDI 4000	231-R-054A
Figure 14-28	2975-0114-01	Housing, Footswitch, Case	213-P-119B
Figure 14-13	2175-0071-01	Keyboard Assy, Alpha	OPT-432-AN/ENG
Figure 14-13	2175-0116-01	Keyboard Assy, Alpha, Philips 4000	A260-063A-ENG (Philips Colors)
Figure 14-13	2175-0061-01	Keyboard Assy, French, Medison, HDI 4000	OPT-432-AN/FRE
Figure 14-13	2175-0124-01	Keyboard Assy, French, Philips 4000	A260-063A-FRE (Philips Colors)
Figure 14-13	2175-0067-01	Keyboard Assy, German, Medison, HDI 4000	OPT-432-AN/GER
Figure 14-13	2175-0122-01	Keyboard Assy, German, Philips 4000	A260-063A-GER (Philips Colors)
Figure 14-13	2175-0066-01	Keyboard Assy, Italian, Medison, HDI 4000	OPT-432-AN/ITY
Figure 14-13	2175-0120-01	Keyboard Assy, Italian, Philips 4000	A260-063A-ITY (Philips Colors)

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-13	2175-0063-01	Keyboard Assy, Spanish, Medison, HDI 4000	OPT-432-AN/ESP
Figure 14-13	2175-0118-01	Keyboard Assy, Spanish, Philips 4000	A260-063A-ESP (Philips Colors)
Figure 14-11	2975-0298-01	Knob, Encoder, Lev10	251-M-005A
Figure 14-11	2975-0448-01	Knob, Encoder, Lev10, Philips 4000	251-M-005E (Philips Colors)
Figure 14-9	2975-0272-01	Knob, Gain, SA88P	M-88P-KNOB/GAIN
Figure 14-9	2975-0449-01	Knob, Gain, SA88P, Philips 4000	M-88P-KNOB/GAIN-HD (Philips Colors)
Figure 14-11	2975-0297-01	Knob, TGC, HDI 4000	267-M-037B
Figure 14-11	2975-0450-01	Knob, TGC, Philips 4000	267-M-037-1C (Philips Colors)
Figure 14-11	2975-0410-01	Knob, TGC, HDI 4000, ABS Slidepot	267-M-037-1
Not shown	4175-0035-01	Label, OEM, System ID, HDI 4000	275-K-A019A
Figure 14-11	2975-0268-01	Lamp, Key	Key Lamp (Includes cable)
Figure 14-13	2975-0302-01	Lock Guide Rail, HDI 4000	235-P-162A
Figure 14-12	2975-0304-01	Lock Magnet, HDI 4000	254-Z-003A
Figure 14-9	2175-0127-01	Module, ECG, Philips 4000	A215-095A (Philips Colors)

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-5	2975-0011-01	Monitor Bowl, HDI 1500 1.5	227-M-065A
Figure 14-5	2975-0451-01	Monitor Bowl, HDI 4000	227-M-065C
Figure 14-3	2175-0082-01	Monitor, Totoku, HDI 4000	MNT-15-TOTOKU 00
Figure 14-3	2175-0125-02	Monitor, Totoku, Philips 4000	MNT-15-TOTOKU/ATL-02 (Philips Colors)
Figure 14-5	1675-0017-01	Nut, Special Stem, HDI 1500	317-L-003A
Figure 14-6	2975-0238-01	Pad, Rubber, Top	311-R-160A
Figure 14-6	2975-0452-01	Pad, Rubber, Top, Philips 4000	311-R-160-1 (Philips Colors)
Figure 13-2 Figure 14-22	See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.	PCB Assy, Beamformer, HDI 4000	
Figure 13-2 Figure 14-22		PCB Assy, CW, HDI 4000	
Figure 13-2 Figure 14-22		PCB Assy, DSC, HDI 4000	
Figure 13-2 Figure 14-22		PCB Assy, DSP, HDI 4000	
Figure 14-9	7575-1875-01	PCB Assy, ECG, HDI 4000	BD-432-ECG-1B

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-11	See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.	PCB Assy, Key/Matrix, Left, HDI 4000	
Figure 14-11		PCB Assy, Key/Matrix, Middle, HDI 4000	
Figure 14-11		PCB Assy, Key/Matrix, Right, HDI 4000	
Figure 13-2 Figure 14-22		PCB Assy, Motherboard, HDI 4000	(Backplane)
Figure 13-2 Figure 14-22		PCB Assy, Motor Control, SA9900, 4D	
Figure 13-2 Figure 14-22		PCB Assy, Mother Board, 4D, HDI 4000	(PC Mother Board)
Figure 14-24	7575-1873-02	PCB Assy, OEM, Power Assembly, HDI 4000	AY-432-PWR-03
Figure 14-24	7575-2042-02	PCB Assy, OEM, Power Assembly, Philips 4000	AY-432-PWR-05

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 13-1 Figure 14-21	See the HDI 4000 Master Compatibility Matrix for the part number and compatible software version of system PCBs.	PCB Assy, PSA, HDI 4000	
Figure 13-2 Figure 14-25		PCB Assy, Rear Panel, Left, HDI 4000	
Figure 13-2 Figure 14-25		PCB Assy, Rear Panel, Middle, HDI 4000	
Figure 13-2 Figure 14-25		PCB Assy, Rear Panel, Right, HDI 4000	
Figure 13-2 Figure 14-23		PCB Assy, Video Manager, HDI 4000	
Figure 14-5	2975-0288-01	Plate, Swivel, Atmneck, HDI 4000	228-P-046B
Figure 14-20	2975-0121-01	Rack and Rail Assy, PCB, HDI 4000	A211-020A
Figure 14-5	2975-0293-01	Ring, Swivel, Fixture, HDI 4000	247-R-005A
Figure 14-5	1675-0018-01	Ring, Swivel, Housing, UM 400C	217-L-002A
Figure 14-5	2975-0294-01	Ring, Thumb, Bolt, HDI 4000	247-R-006A
Figure 14-5	2975-0292-01	Ring, Tilt, Swivel, HDI 4000	247-L-004A
Figure 14-12	1675-0002-01	Screw, M3x8, with Washer, HDI 1500, 1.5	Secures probe holders to the control module.
Figure 14-15 Figure 14-16	1675-0021-01	Screw, Oem	316-L-011A
	See Table 13-1	Software	

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-7	2175-0085-01	Speaker Assy, Left, HDI 4000	A213-046A
Figure 14-7	2175-0084-01	Speaker Assy, Right, HDI 4000	A213-045A
Figure 14-15	2975-0116-01	Support, Printer, HDI 4000	233-P-124A
Figure 14-15	2975-0454-01	Support, Printer, Philips 4000	233-P-124-1 (Philips Colors)
Figure 14-16	2975-0115-01	Support, VCR, HDI 4000	233-P-123A
Figure 14-16	2975-0455-01	Support, VCR, Philips 4000	233-P-123-1 (Philips Colors)
Figure 14-12	2975-0305-01	Switch, Lamp, Alpha	265-C-007A
Figure 14-11	3275-0001-01	TGC Slidepot	VR-SLD-50KB-A-1
Figure 14-11	2175-0043-01	Trackball Assy, 58mm, Black	AY-TB-B/58-UNIT
Figure 14-11	2100-1890-01	Trackball Assy, Philips 4000	A335-004A (Philips Colors)
Figure 14-11	2975-0464-01	Track, Dark Yellow Unit, 58mm, HD	335-C-007A
Figure 14-10	2175-0050-01	UIF Assy, English, Medison, HDI 4000	OPT-432-KB/ENG
Figure 14-10	2175-0115-01	UIF Assy, English, Philips 4000	A260-064A-ENG (Philips Colors)
Figure 14-10	2175-0060-01	UIF Assy, French, Medison, HDI 4000	OPT-432-KB/FRE
Figure 14-10	2175-0123-01	UIF Assy, French, Philips 4000	A260-064A-FRE (Philips Colors)
Figure 14-10	2175-0070-01	UIF Assy, German, Medison, HDI 4000	OPT-432-KB/GER

Table 14-1 HDI 4000 System Parts List (Continued)

Located On	Part Number	Part Description	Notes/Ref (Medison P/N)
Figure 14-10	2175-0121-01	UIF Assy, German, Philips 4000	A260-064A-GER (Philips Colors)
Figure 14-10	2175-0069-01	UIF Assy, Italian, Medison, HDI 4000	OPT-432-KB/ITY
Figure 14-10	2175-0119-01	UIF Assy, Italian, Philips 4000	A260-064A-ITY (Philips Colors)
Figure 14-10	2175-0068-01	UIF Assy, Spanish, Medison, HDI 4000	OPT-432-KB/ESP
Figure 14-10	2175-0117-01	UIF Assy, Spanish, Philips 4000	A260-064A-ESP (Philips Colors)

Table 14-2 Peripheral Part Numbers

Located On	Part Number	Part Description	Notes/Reference
Color Video Printer			
Figure 1-6	3500-3063-01	Printer, Color, Mitsubishi, CP800UM, 120V	NTSC
Figure 1-6	3500-3064-01	Printer, Color, Mitsubishi, CP800E, 240V	PAL
Figure 1-6	2100-1852-01	Printer, Color, Sony, UP-21MD/SYN	NTSC/PAL To avoid damaging the Sony UP-21printer, be sure to secure the print head before shipping as described in “To secure the Sony UP-21 print head for transport:” on page 182.
Black-and-White Video Graphic Printer			
Figure 1-6	2100-1855-01	Printer, B/W, Sony, UP-895MD/SYN	NTSC/PAL

15 Scanheads

Introduction

This section summarizes scanhead specifications for the HDI 4000 Ultrasound System.

Scanhead Specifications

Table 15-1 Scanhead Applications

Scanhead	Application
D2 CW	CARDIAC
D5 CW	CARDIAC, VASCULAR
3D5-3	GENERAL, OB, GYN, ABDOMINAL
3D7-4	GENERAL, OB, GYN, ABDOMINAL
3D8-5v	GENERAL, OB, GYN
C5-2	GENERAL, ABDOMEN, RENAL, OB, FETAL ECHO, GYN
C7-4	GENERAL, ABDOMEN, RENAL, OB, FETAL EHCO, GYN
C8-4v	GENERAL, OB, GYN
C8-5	GENERAL, NEO-NATAL HEAD, VASCULAR, PEDIATRIC ABDOMEN
C9-5 ICT	GENERAL, PROSTATE, GYN, OB
CL15-7	GENERAL, SMALL PARTS, MUSCULOSKELETAL, VASCULAR, INTRA-OPERATIVE
L7-4	GENERAL, CAROTID, SMALL PARTS, MUSCULOSKELETAL, VENOUS

Table 15-1 Scanhead Applications (Continued)

Scanhead	Application
L12-5	GENERAL, VASCULAR, SMALL PARTS, MUSCULOSKELETAL, PEDIATRIC, BREAST
MPT7-4	GENERAL, CARDIAC TEE
P4-2	GENERAL, CARDIAC, ABDOMINAL, TRANSCRANIAL DOPPLER (TCD), RENAL
P5-3	GENERAL, CARDIAC, ABDOMINAL
P7-4	GENERAL, PEDIATRIC CARDIOLOGY, NEONATAL HEAD

Table 15-2 Scanhead Types, Capabilities, and Advantages

Type	Capabilities	Advantages
Linear array		
L7-4	2D, C, PWD, M, CPA mode	Dynamic receive focus for optimal lateral resolution
L12-5 38 mm		Multiple transmit focal zones
L12-5 50 mm		Wide field of view (Trapezoidal)
CL15-7		High frame rate
		Excellent tissue definition and contrast resolution
		Excellent small parts imaging

Table 15-2 Scanhead Types, Capabilities, and Advantages (Continued)

Type	Capabilities	Advantages
Curved Array		
C5-2 C7-4 C8-5 C9-5 ICT C8-4v	2D, C, PWD, M, CPA, Freehand 3D mode	Combines the advantages of phased array and linear array scanheads Multiple transmit focal zones Sector format with wide field of view at skin surface Good lateral resolution Dynamic receive focus Excellent resolution and detail Design is lightweight and easy to use
Phased Array		
P4-2 P5-3 P7-4 MPT7-4	2D, C, PWD, M, CPA, CW mode	Multiple transmit focal zones Dynamic receive focus MPT7-4 for transesophageal applications
Dual Element Pencil Scanhead		
D2 CW D5 CW	CW mode	Good CW Doppler ensemble

Table 15-2 Scanhead Types, Capabilities, and Advantages (Continued)

Type	Capabilities	Advantages
Volume Scanhead		
3D7-4 3D8-5v 3D5-3	2D, C, PWD, M, CPA, Volume 3D mode	Easy to obtain 3D images Dynamic receive focus for optimal lateral resolution Multiple transmit focal zones Wide field of view (Trapezoidal) High frame rate Excellent tissue definition and contrast resolution Excellent small parts imaging

Table 15-3 Scanhead Information

Scanhead Name	Number of Elements	Scanhead Label	Operating Frequency	Doppler Frequency
D2 CW	2	Dual Element Pencil Scanhead 2.0 CW	n/a	See Table 15-4
D5 CW	2	Dual Element Pencil Scanhead 5.0 CW	n/a	
3D5-3	128	Volume Scanhead S-VAW3-5	2.5–5.0 MHz	
3D7-4	128	Volume Scanhead S-VAW4-7	3.2–6.5 MHz	
3D8-5v	128	Volume Scanhead S-VDW5-8B	4.5–8.0 MHz	
C5-2	128	Curved Array C5-2	3.0–4.2 MHz	
C7-4	128	Curved Array C7-4	5.0–6.2 MHz	
C8-4v	128	Curved Array C8-4v	6.2–7.6 MHz	
C8-5	128	Curved Array C8-5	6.4–7.8 MHz	
C9-5 ICT	128	Curved Array C9-5	6.0–7.3 MHz	
CL15-7	128	Linear Array CL15-7	4.25–10 MHz	
L7-4	128	Linear Array L7-4	5.4–6.8 MHz	
L12-5 38 mm	192	Linear Array L12-5 38 mm	7.5–10 MHz	
L12-5 50 mm	256	Linear Array L12-5 50 mm	7.2–10 MHz	
MPT7-4	64	Phased Array MPT7-4	5.4–6.3 MHz	
P4-2	64	Phased Array P4-2	2.8–3.2 MHz	
P5-3	64	Phased Array P5-3	3.5–4.3 MHz	
P7-4	64	Phased Array P7-4	4.8–6.3 MHz	

Table 15-4 Scanhead Doppler Frequencies

Scanhead	Application	Doppler Frequency
D2 CW	Cardiac	3.080
D5 CW	Cardiac	3.080
	Vascular	3.080
3D5-3	Abdomen	2.567
	General	2.567
	Gynecology	2.567
	OB	2.567
3D7-4	Abdomen	2.800
	General	2.800
	Gynecology	2.800
	OB	2.800
3D8-5v	General	5.133
	Gynecology	5.133
	OB	5.133
C5-2	Abdomen	2.567
	Fetal Heart	2.567
	General	2.567
	Gynecology	2.567
	OB	2.567
	Renal	2.567

Table 15-4 Scanhead Doppler Frequencies (Continued)

Scanhead	Application	Doppler Frequency
C7-4	Abdomen	3.624
	Fetal Heart	3.624
	General	3.624
	Gynecology	3.624
	OB	3.624
	Renal	4.107
C8-4v	General	5.133
	Gynecology	5.133
	OB	5.133
C8-5	General	5.133
	Neonatal	5.133
	Pediatric Abdomen	5.133
	Vascular	5.133
C9-5 ICT	General	5.133
	Gynecology	5.133
	OB	5.133
	Prostate	5.133

Table 15-4 Scanhead Doppler Frequencies (Continued)

Scanhead	Application	Doppler Frequency
CL15-7	General	6.160
	Intra Operative	6.160
	Musculoskeletal	6.160
	Small Parts	6.160
	Vascular	6.160
L7-4	Carotid	4.738
	General	4.738
	Musculoskeletal	4.107
	Small Parts	4.400
	Venous	4.738
L12-5 38 mm	Breast	5.600
	General	5.600
	Musculoskeletal	5.600
	Pediatric	5.600
	Small Parts	5.600
	Vascular	5.600

Table 15-4 Scanhead Doppler Frequencies (Continued)

Scanhead	Application	Doppler Frequency
L12-5 50 mm	Breast	5.600
	General	5.600
	Musculoskeletal	5.600
	Pediatric	5.600
	Small Parts	5.600
	Vascular	5.600
MPT7-4	Cardiac Tee	3.850
	General	3.624
	Cardiac Tee CW	3.850
	General CW	3.624
P4-2	Abdomen	2.464
	Cardiac	2.464
	General	2.464
	Renal	2.464
	TCD	2.053
	Abdomen CW	2.464
	Cardiac CW	2.124
	General CW	2.124
	Renal CW	2.464
	TCD CW	2.053

Table 15-4 Scanhead Doppler Frequencies (Continued)

Scanhead	Application	Doppler Frequency
P5-3	Abdomen	2.800
	Cardiac	2.800
	General	2.800
	Abdomen CW	2.800
	Cardiac CW	2.800
	General CW	2.800
P7-4	General	3.850
	Neonatal	3.850
	Pediatric Cardiology	3.850
	Pediatric Cardiology	3.850

Table 15-5 Scanhead Part Numbers

Scanhead Type and Name	Part Number	Current Dash Number	Hardware Notes	Software Compatibility
D2 CW Static Probe	4000-0307	05 Alt. 04, 03		v1.00.01.030 and up
D5 CW Static Probe	4000-0308	02		v1.00.01.030 and up
3D5-3	2175-0073	01	Biopsy guide available[1]	v1.00.01.030 and up 3D feature must be enabled

Table 15-5 Scanhead Part Numbers (Continued)

Scanhead Type and Name	Part Number	Current Dash Number	Hardware Notes	Software Compatibility
3D7-4	2175-0074	01	Biopsy guide available[1]	v1.00.01.030 and up 3D feature must be enabled
3D8-5v	2175-0075	01	Biopsy guide available[1]	v1.00.01.030 and up 3D feature must be enabled
C5-2	4000-0574	05	Biopsy guide available[1]	v1.00.01.030 and up
C7-4	4000-0301	07 Alt. 03	Biopsy guide available[1]	v1.00.01.030 and up
C8-4v	4000-0409	05 Alt. 03, 02	Biopsy guide available[1]	v1.00.01.030 and up
C8-5	4000-0800	02 Alt. 01	Biopsy guide available[1]	v1.00.01.030 and up
C9-5 ICT	4000-0280	16 Alt. 10	Biopsy guide available[1]	v1.00.01.030 and up
CL15-7	4000-0765	02		v1.00.01.030 and up
L7-4	4000-0318	09 Alt. 06, 05	Biopsy guide available[1]	v1.00.01.030 and up
L12-5 38 mm	4000-0396	06 Alt. 04, 03, 02	Biopsy guide available[1]	v1.00.01.030 and up

Table 15-5 Scanhead Part Numbers (Continued)

Scanhead Type and Name	Part Number	Current Dash Number	Hardware Notes	Software Compatibility
L12-5 50 mm	4000-0762	05 Alt. 03, 02, 01	Biopsy guide available[1]	v1.00.01.030 and up
MPT7-4	4000-0317	19 Alt. 18, 17		v1.00.01.030 and up
P4-2	4000-0660	04 Alt. 03	Biopsy guide available[1]	v1.00.01.030 and up
P5-3	4000-0316	06 Alt. 05	Biopsy guide available[1]	v1.00.01.030 and up
P7-4	4000-0322	02 Alt. 03	Biopsy guide available[1]	v1.00.01.030 and up

1. See “Supplies and Accessories” on page 36.

16 Glossary

Acronyms and Abbreviations

AC	alternating current
A	amperes
ADC	analog-to-digital conversion
Assy	assembly
B/W	black and white
COA	Customer Order Acknowledgment
CPU	central processing unit
CW	continuous-wave
DAC	digital to analog converter
D/A	digital-to-analog converter
DC	direct current
DICOM	Digital Imaging and Communications in Medicine
DR	Dynamic range
DVM	Digital volt meter
ECG	Electrocardiogram
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic sensitive device or electrostatic discharge
I-RGB	Interlaced red, green, and blue video
IVT	Intravaginal transducer
LED	Light emitting diode
MUX	Multiplexer

NTSC	National Television Standards Committee
OEM	Original equipment manufacturer
PAL	Phased Alternating Line
PC	Personal computer
PCB	Printed circuit board
PD	Phased drive
PW	Pulsed-wave
RF	Radio frequency
Rx	Receive, receiver
S-VHS	Super VHS, a VCR video format
TGC	Time gain compensation
Tx	Transmit, transmitter
UIF	User interface
VCR	Video cassette recorder

Terms

CAUTION	Information in the manual set that describes precautions necessary to protect the equipment.
Digital Imaging and Communication in Medicine (DICOM)	Standard for network communication. The system provides network communication with devices that comply with version 3.0.
Electromagnetic interference (EMI)	Noise or other external signals generated by electrical devices that can disturb the performance of electronic devices.
Help	Sometimes referred to as online Help. System software files that provide instructions for use of the HDI 4000 system, on-screen, by pressing the ? button on the control panel.
I-RGB	Interlaced, red, green, and blue video. The system has a rear panel connector for video devices that use this type of video.
interlaced	Video format where two fields make up one 30 Hz frame. Video rows (scan lines) of the raster are interlaced, that is, field one provides rows 1, 3, 5,..., then field two fills in rows 2, 4, 6,... See “non-interlaced”.
National Television Standards Committee	Standard video signal for all broadcast TV in the U.S. -525-line, 60Hz, composite video, usually color.
Non-interlaced	Video format where the video rows are processed in sequence (1, 2, 3, 4, 5, 6,...) and updated at a 60 rate. See “interlaced”.
QWERTY keyboard	A keyboard layout named for its six leftmost characters; the standard layout of most computer keyboards.

Phased Alternating Line	European video standard -625-line, 50Hz composite video, usually color.
WARNING	Information in the manual set that describes precautions necessary to prevent injury or loss of life.